

EXHIBIT A

25-15-22

12-17

MISAR, ET. FEBERLING, SULLIVAN, COOK & LEAVITT, LTD.

12-17

PERFORMANCE REPORT
 Up Industrial Chemicals RCA No. 12-2
 sion Construction Products Date Approved April 3, 1975
 Reporting Unit U.S. Zonolite Operations

	(1)	(2)	(3)	(4)
	Amount of Expenditure (\$000)	Average Grace Capital Employed	Net Income	Percent Return on GCE
(1) RCA Projection	\$10,200	\$38,077	\$4,572	12.0%
(2) Actual	9,799 (a)	27,201	4,035	14.8
<u>Variance/Fav/(Unfav)</u>	\$ 401	\$10,876	\$ (537)	2.8% Pts.
(3) Amount	3.9%	28.6%	(11.7)%	
(4) Percent				

PLAINTIFF'S
EXHIBIT

MDL 1376

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RCA #12-2, entitled "Overrun - New Vermiculite Mill - Libby, Montana", requested to spend an additional \$2,600,000 (for a total expenditure of \$10,200,000) to complete the replacement of Construction Products Division's (CPD) vermiculite mill in Libby, Montana. The objectives of this project were (a) to increase Zonolite vermiculite milling capacity from 310,000 tons in 1970 to 426,000 tons annually by 1977, (b) to improve milling productivity and thereby lower direct manufacturing costs, and (c) to comply with federal and state pollution requirements.

After two years (1975 and 1976) of start-up problems and process design modifications at the new Libby mill, Zonolite's vermiculite milling capacity is presently estimated at 450,000 tons annually or 24,000 (5.6%) ahead of RCA #12-2 projections. The Enoree, South Carolina milling capacity is estimated at 122,000 tons or 12,000 (10.9%) above RCA #12-2, while the Libby, Montana operation has an estimated annual capacity of 329,000 tons or 12,000 tons (3.8%) favorable to RCA projections. In 1977, the new Libby mill produced 1,005 tons of vermiculite concentrate per day (TPD) which was 53 TPD (5.6%) favorable to RCA #12-2 projections. This favorable operating performance is primarily due to improved mill reliability (2 On-Stream Time of 96.1% versus 92.0% as projected in RCA #12-2) and a mill feed rate of 250 tons per hour (TPH), which is 15 TPH (6.4%) ahead of RCA projections. *not including min. of costs*

In addition to exceeding the RCA output objectives, the direct manufacturing costs at the Libby mill were \$11.851 per ton of concentrate produced which was \$2.737 (19.8%) favorable to the RCA #12-2 estimate of \$14.58 per ton. This favorable cost performance is primarily attributable to the 5.6% increase in daily output, coupled with lower reagent consumption resulting from the process design improvements made to the mill feed preparation circuits as part of the RCA #12-2.

The pollution problems which were identified in RCA #12-2 (i.e., excessive levels of fugitive dust from the dry screening circuits, particulate emissions from the ore dryer stacks, and mill tailings (waste) being carried by the spring run-off into the Kootenai River) have been eliminated. If Zonolite had not been actively working to solve these pollution problems at Libby, a forced shutdown of the facilities would have occurred in 1976.

(a) As of December 31, 1977, \$9,799,000 (96.1%) of the authorized \$10,200,000 has been spent. An additional \$401,000 will be spent in 1978 for further mill improvements bringing total spending to \$10,200,000.

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Emergency Notice

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initial new standard
new asbestos at 2.6%
new standard
new asbestos
anticipate

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While the pollution related objectives of RCA #12-2 have been resolved, Zonolite is presently faced with tightening government standards covering exposure to asbestos fibers. Vermiculite concentrate contains naturally occurring trace quantities (less than 0.2%) of fibrous tremolite asbestos. As all forms of asbestos including tremolite, classified as carcinogens, Zonolite's mines, expanding plants, products, and customers are subjected to a host of regulations being promulgated by the Occupational Safety and Health Administration (OSHA), Mine Safety and Health Administration (MSHA), Consumer Products Safety Commission (CPSC), the Environmental Protection Agency (EPA) and others including a variety of state level agencies. At the present time all of Zonolite's products and operations satisfy existing regulatory standards covering exposure to asbestos. The new mill at Libby has been an important factor in meeting these standards. While research continues to work toward further reducing tremolite from the vermiculite concentrate and our products, Zonolite remains subject to all asbestos regulations.

In 1977, the Zonolite business generated net income (Grace Share) of \$4,035,000 on net sales of \$85,483,000 for a 14.8% return on average Grace Capital Employed of \$27,201,000. While this 14.8% return on GCE is 2.8 percentage points favorable to the 12.0% return as projected in RCA #12-2, the actual 1977 sales volume is approximately 18.3% below RCA #12-2 estimates. Since the RCA was prepared, Zonolite has been operating in a severely depressed construction economy. Nonresidential building activity in 1977, which represents approximately 56% of Zonolite net sales, is estimated to be 32.1% below 1974 levels. The length and severity of this downturn was not anticipated by CPD management, nor by any of the major economic forecasters (i.e., F. W. Dodge, Data Resources, and Grace's Business Economics Group) at the time RCA #12-2 was prepared. Despite this precipitous drop in construction activity, Zonolite net sales have increased at an average annual rate of 9.9% from 1974 to 1977, while net income grew at an average annual rate of 78.8% over the same period. This rapid growth in net income is primarily due to the resolution of Libby mill start-up problems and a 57.5% improvement in Libby productivity (from 638 tons per day in 1974 to 1,005 tons per day in 1977).

The following table presents key data for U.S. Zonolite Operations for actual results since 1973 and forecasted performance over 1978B - 1982F.

(See table on the following page)

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U.S. Zonolite Operations (\$000)Key Data

Line No.	Year	Net Sales	Net Income (Grace Share)	Average Capital Employed		% Return on TCE	
				GCE	(Incl. Cap. Leases)	GCE	% Return on TCE (Incl. Cap. Leases)
							TCE
(1)	1973A	\$46,639	\$2,479	\$23,903	\$24,662	10.4%	10.6%
(2)	1974A	49,307	706	26,522	28,867	2.7	2.9
(3)	1975A	53,240	1,153	27,115	29,119	4.3	4.2
(4)	1976A	55,755	1,512	27,369	29,247	5.5	5.4
(5)	1977A	65,483	4,035	27,201	29,079	14.8	14.1
(6)	1977 Per RCA #12-2	78,454	4,572	38,077	40,385	12.0	11.8
(7)	1978B	70,863	3,730	30,642	32,520	12.2	11.7
(8)	1979F	79,576	4,301	33,584	35,462	12.8	12.3
(9)	1980F	88,485	5,024	35,919	37,796	14.0	13.5
(10)	1981F	98,585	5,591	37,891	39,769	14.8	14.3
(11)	1982F	110,118	6,009	39,931	41,809	15.0	14.6
<u>% Variance Fav/(Unfav)</u>							
77A vs. 77							
(12)	Per RCA #12-2	(16.5)%	(11.7)%			2.8% Pts.	2.3% Pts..
<u>% Average Annual Change Fav/(Unfav)</u>							
(13)	1973A - 1977A	8.9%	13.0%	(3.3)%	(4.2)%		
(14)	1977A - 1982F	11.0	8.3	(8.0)	(7.5)		

Zonolite net sales are forecasted to increase at an average annual rate of 11.0% reaching \$110,118,000 in 1982, while net income is projected to be \$6,009,000 in 1982 for a 14.6% return on ICE of \$41,809,000. The forecast reflects an improving construction economy throughout the forecast period. In addition, the energy shortage will continue to stimulate demand for building insulation products. At the time the 1978 Budget and Forecast was prepared, the sales of Zonolite insulation products were not expected to reach the 1977 volume levels until 1980 and Zonolite's return on ICE was not expected to exceed 14.0% before 1981. Although shortages of competing insulating materials contributed to Zonolite's high volume of insulation product sales in 1977, we now believe our forecasts are conservative. If sales of insulation products in 1978 continue at 1977

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record levels, then Zonolite's net income could reach \$4,700,000 in 1978 for a 14.7% return on TCE of \$32,520,000. However, at this time, it remains extremely difficult to predict when insulation sales will peak and what, if any, impact the pending energy legislation in Congress will have on Zonolite's insulation products. Finally, sales on non-construction related products, particularly agricultural/horticultural products, are expected to provide growth opportunities for Zonolite based upon trends such as increased leisure time and continuing interest in ecology.

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EXHIBIT B

CM 11/11/2023

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GRACE

Geography of Indian Rivers

W. E. Grace & Co.
63 Whitemore Avenue
Concord, Mass. (C. 4)

14121 876.145

•October 7, 1983

TO: R. J. Beccacchi
FROM: G. N. Ciampa
SUBJ: Monthly Report - September 1983

Business Summary

Polycel Products - Total shipments during the month of 69.0M lbs are 15.9% behind budget but are 11.3% ahead of September 1982.

Strong sales in Texas and the Central region in Professional accounted for the majority of the overrun.

Sales through our consumer and industrial reps were strong enough (31.0M lbs.) to offset the aerosol sales downturn in the Central and Eastern regions.

Wall Insulation Products - ZMI sales volume of 212.0M bags were 9.8% ahead of last September and 7.6% ahead of budget. Year to date sales volume of 1643M bags are 3.3% ahead of September 1982 and 5.0% ahead of budget.

Thermo-stud sales of 582 MBF were disappointing after strong sales in July and August; we felt September would be even better. Sales volume for the month were 34.41 behind last September and behind budget by 52.2%. Year to date sales volume is even with last year but behind budget 33.9%.

Attic Insulation - Sales volume of 88.0M bags are for the sixth straight month below 1982 levels. Year to date sales volume is 16.5% below last year.

See product volume summary chart on next page for detailed analysis of monthly and year to date volumes.

WB0002985

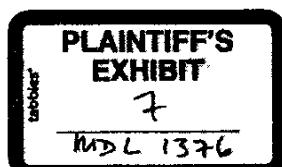
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Emergency Notice

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Market and Competition

Polycel Products

In mid-September we launched a major program aimed at regaining business in Texas. We are offering competitive prices and extended payment to twenty-seven target accounts.

We're on the right track - we have sold 4.0M lbs. in a short period of time. Eagle Insulators, Inc. has taken advantage of the program and ordered 1.0M lbs. Their purchases in 1983 prior to this were only 1.2M lbs. versus 13.2M lbs. thru September 1992. We also regained Diversco's business in Dallas. They ordered 1.8M lbs. under the program. When they were a full time customer in 1981, they purchases over 10.0M lbs.

Owens Corning management have approved Polycel One for sale through their sixty-five supply centers. Polycel is the only foam sealant in an aerosol can that they have allowed their supply centers to sell. We have received orders already for 120 cases from the Louisville and Cincinnati centers.

We participated in several dB Plus acoustical sealant seminars put on at the Owens Corning branches in Columbus and Cincinnati. These seminars were a joint effort between Mike Ragan's people and the Owens Corning branch managers. As a result of the effort O.C. is stocking dB Plus. They were successful in securing distribution in Louisville and Cincinnati.

Polycel One is being advertised by Coaster/True Value in October in the following magazines: BETTER HOMES AND GARDENS, FAMILY CIRCLE, MECHANICS ILLUSTRATED, POPULAR SCIENCE, POPULAR MECHANICS, SPORTS ILLUSTRATED, (World Series Preview) and OUTDOOR LIFE. Also the True Value direct mail circular going out in October to 20.3 million homes will also feature Polycel. The advertising we are receiving is an example of co-op advertising at its best. For a fraction of what it would actually cost, our product will be brought before over 100.0 M people in October.

M. Toben has received an order for a new consumer account in the Northwest. T & A has ordered 1400 cans of PCS's and an order is pending from the Angels centers in Southern California.

The industrial business appears to be picking up. We have lowered our price in two areas of the country to keep from losing business. We also introduced a 5% sales increase in PCS's effective 9/15/83. Now that the fall weather has arrived we should expect to see a surge over the next three months.

In September leads received from the JULY BUILDER magazine were sent out to our certified contractors and distributors. Also a copy of the leads and letters sent to our customers was sent out to the Polycel specialists for follow up.

Wall Insulation

Central Regional Management has agreed to change over to the revised T-clip system. New clips and the new channel have already been shipped to the Milwaukee plant.

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0641PS1

Two new T-clip jobs were started in September. One job is in Waco, Texas and that is a 2 1/2 inch job and the second, a 3 inch job in Florida.

We signed the Dryvit agreement and have returned it to them. We are waiting at this point for Dryvit's approval and we can begin to actively pursue this business in Phoenix, Arizona and in Southern California. There are currently 100.0M board feet of material aging at the South Gate facility.

Another OCF Supply Center has been added to the Thermostud distributor list. The supply center in Atlanta purchased a half truckload of Thermostud for their warehouse and began marketing the product in September. This is the first OC supply center in the Southern Region to begin marketing Thermostud.

A slide presentation explaining the revised Thermostud T-clip system has been distributed to the regional offices as an aid to helping the sales force introduce the revised system to distributors.

The ZMI incentive program ended in September. We know the program was successful and a detailed analysis will follow.

We continue to get reports that EPS scrap is winning in obtaining acceptance at the contractor level over ZMI. We are developing sales tools to aid in defeating this low price competitor.

The 1984 Sweet's catalogs for the Thermostud system with the new T-clip and channel as well as ZMI have been completed and are printed.

Attic Insulation

Overall, poor insulation sales at the retail level have affected attic insulation. Even the best campaign doesn't seem to be able to compete with 80 and 90 degree temperatures. With many stores carrying last year's inventory and consumers who aren't interested we have a product which is behind last year by 20%.

Research and Development

Polycal Products

In October we will begin the market test of the new improved A-1 catalyst. We are producing one hundred PC60-D's and one PC3600. These will be distributed around the country to specific accounts. We will attempt to observe the operation of as many of the A-1 catalyst tanks in the field as possible.

The private label 9.5 board foot two-component kit continues to elude us. The latest delivery date is October 15th. Since we have been promised this for the last four months, I don't put a lot of faith in this event occurring.

In Texas we experienced several failures of the new refill valve. The problem with the valve has been identified and steps have been taken to correct it. We have also contacted our original European valve supplier. They have sent us pricing and samples of valves which we will evaluate.

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We are going to have to identify another source of aerosol cans. Southern Can has to date never met many of their promised ship dates. It is especially important during this season that they do meet those dates.

Wall Insulation

A wall has been constructed for the guarded hot box test on the Thermostud system with the T-clip. We should know in October what the in-place performance is of the Thermostud system with the T-clip. We can compare this to these performance results from our computer model.

As stated earlier we are requesting research help to determine the static charges of ZMI and EPS scrap. If our sales force can show proof that EPS scrap's high static charge prevents it from completely filling blockcores we may be able to deter sales of EPS scrap without lowering ZMI prices. In addition we plan to have some thermographs produced of separate block walls filled with EPS scrap and ZMI. This should graphically reveal that ZMI is a superior product in filling and insulating the cores of a block wall.

G. N. Ciampa

CNC:jm

WR0007988

EXHIBIT C

Copy
R.L.B.
7/31/63

06046312

September 12, 1956

Mr. Dohrman H. Byers, Ass't Chief
Toxicological Section
Public Health Service
1014 Broadway
Cincinnati 2, Ohio

Dear Dohrman:

I appreciate receiving your letter of September 5, concerning the samples I sent collected from the Zonolite Company and your comments on the asbestos situation. However, I believe that in my letter I should have mentioned a circumstance that might change your thinking on this somewhat, in that, even though the ore being treated by the Zonolite Company may have from 8 to 21 percent asbestos content at this time, a very small increase in asbestos content causes several factors increase in dust concentration. In other words, when nearly pure zonolite or vermiculite is being run, the dust concentration is at a pretty constant level. With a very small increase, say, of 5 or 10 percent in the asbestos content, the dust concentration goes up by several hundred per cent. Under these circumstances, the percentage asbestos in the dust in the air would be considerably more than the percentage in the material being processed.

At the first opportunity, I plan to make some analyses, or attempt to make some analyses of the increase in dust concentration with the increase in asbestos content. The company at this time, I believe, estimates the asbestos content of their ore by comparing a sample of material taken off certain size screens with bottles of prepared material in fixed quantities by color. The bottles are laboriously prepared by simply picking out certain number of pieces of asbestos, which is white in comparison to the relatively brown color of the vermiculite, mixing this with a certain number of particles of the same size of vermiculite, and obtaining a certain color. This appears to be about the only method they have of estimating the quantity of asbestos in the material. They take these estimates quite regularly from each lot of ore that is being processed.

I would appreciate any further information you may happen to run across concerning this matter.

Sincerely yours,

20156270

EW/hasd

Benjamin F. Wake
Acting Industrial Hygiene Engineer
Disease Control Division

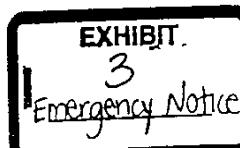


EXHIBIT D

CAMBRIDGE

CONFIDENTIAL

REC APR 20 1977

TO: E. S. Wood

DATE:

April 19, 1977

FROM: Julie C. Yang

SUBJECT:

Tremolite Content
in ZONOLITE® Products

cc: H. C. Duecker
H. A. Eschenbach
F. W. Eaton
W. R. Hanlon
R. M. Vining
B. R. Williams
J. W. Wolter

C. C. Ou
S. C. Vaughan
File: 71-046

OBJECTIVE:

The objective of this study is to determine the tremolite content in all ZONOLITE products made of both Libby and Kearney vermiculites. In a few cases, repetitious analyses were made for product used on job-sites, so that correlation can be made with the fiber counting results.

METHOD

When tremolite is determined from the product as received, in most products tremolite was not found by conventional analytical methods. The trace amount can be determined only when intensive concentration techniques are employed. Tremolite determinations are then made from the fractions by quantitative x-ray diffraction analysis and with the aid of petrographic microscopic examination.

1. Terra-Lite Vermiculites, Verxite, Redi-Earths and Metro-Mires

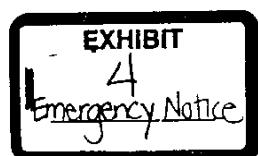
The schematic method of analysis and the results have been reported in T&A 50110 with limited distribution. They are also reported here as shown in schemes 1, 2, and 3.

2. Scott Turf Builder

The method of concentration was very similar to that of Terra-Lite Vermiculite scheme #1, except in the water flotation step. A longer soaking period was needed to solubilize all the nutrients present, which was approximately 50% of the total weight.

3. ZIC, Attic Fill, Masonry Fill

Same concentration method as Terra-Lite (scheme #1).



To: E.S.Wood
 From: J.C.Yang
 April 19, 1977

Tremolite Content
 in ZONOLITE® Products
 Page 2

4. MONOKOTE

Analysis of tremolite in MONOKOTE was the most difficult and time-consuming procedure. The glass fibers were screened off, plaster of Paris was dissolved in water about 50-100 times the weight, expanded vermiculite was floated off, and all the washings were combined, filtered and dried. The filter paper and the organic matter were then burnt off; the remaining residue was x-rayed for the tremolite analysis. Detailed separation and concentration procedure is shown in scheme #4.

5. ZONOLITE 3300

Separation and concentration techniques are similar to that of MONOKOTE, but dilute acid (in HCl) was used to digest the portland cement binder instead of using large excess of water for solubilizing plaster of Paris. The procedure is shown in scheme #5.

RESULTS

A. Tremolite Content in ZONOLITE Products

Kearney

ID No.	Product Description	% Tremolite
1	ZIC K-4 Kearney	5.466
2	ZIC K-4/5 B	1.715
4	Masonry Fill K-4	1.605
9	Masonry Fill K-3	.0504
11	MK-4 Kearney 3	<0.08
13	MK-5 Kearney 3	<0.08
17	Terra-Lite Kearney	4.319
18	Terra-Lite T.R.	0.016
20	Metro Mix 200 T.R.	(as rec'd) 0.398 (dried) * .477
21	Redi-Earth T.R.	(as rec'd) 0.048 (dried) .071
23 (5)	Verdite Carrier Grade #4, Kearney (St.Louis)	0.083 (<0.008)
26	Metro-Mix 300, T.R.	(as rec'd) 0.081 (dried) 0.121
27	Metro-Mix 350, T.R.	(as rec'd) 0.156 (dried) 0.259

* Metro-Mixes and Redi-Earths were computed both in as-received basis and oven-dried basis since the product has substantial amount of moisture.

E. S. Wood
a: J. C. Yang
li 20, 1977

Tremolite Content
in ZONOLITE[®] Products
Page 3

by

Product Description	% Tremolite
MX-4 (L-3) West Chicago	< 0.10
Masonry Fill (L4D-18) West Chicago	0.01
Terra-Lite, W. Chicago	0.035
Attic Fill (L-2) W. Chicago	.013
Redi-Earth (L) Santa Ana	(as rec'd) .031
Redi-Earth (L) W. Chicago	< 0.02 (dried) .051
Metro-Mix 200 (L) W. Chicago	(as rec'd) 0.034
Zonolite 3300 (L-3) W. Chicago	< 0.007
Concrete Aggregate (L4D-18) W. Chicago	0.344
Scott Turf Builder (L) Dark	< 0.009
Scott Turf Builder (L) Light	< 0.009

B. Tremolite Content in Zonolite Job-site Samples

ID No.	Product Description	Location	% Tremolite
8	ZK Roof Deck (K 4/5 B)	Montgomery, Ala.	2.828
9	Masonry Fill (K-3)	Columbus, Ohio	0.050
28	Redi-Earth (L-4)	Forest Service, Santa Ana	0.031 (.051)*
51	Monokote-5 (L-3)	San Diego	< 0.106
54	Masonry Fill (K-4)	W. Palm Beach, Fla.	2.86
55	ZIC (K-4)	Edison H.S., Miami, Fla.	0.476
58	Masonry Fill (L-3)	Mashburn & Coe Bldg., Oklahoma	0.250
57	Monokote-4 (L-3)	Hyatt Regency, Dallas	0.240

*oven-dried basis

DISCUSSION and COMMENTS

1. Some of the Kearney products showed high "tremolite" content since x-ray diffraction method cannot distinguish massive tremolite (Hornblende?) and fibrous tremolite. Microscopically, most of the Kearney material showed trace or absence of fibers.

2. Tremolite fibers can be reduced if a screened vermiculite is used such as in verite. We have observed that most of the fibers are concentrated in the fines.

To: E. S. Wood
From: J. C. Yang
April 20, 1977

Tremolite Content
in ZONOLITE® Products
Page 4

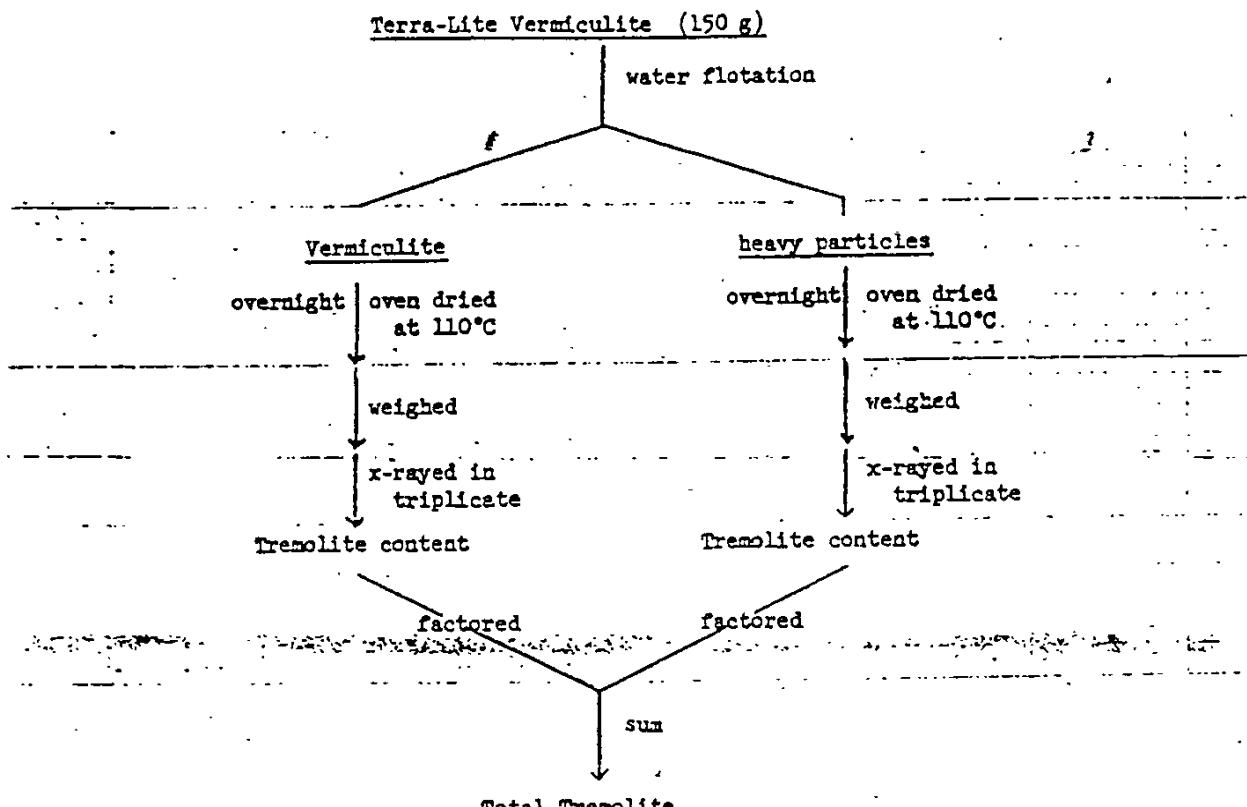
3. The percentage of tremolite in several samples was expressed in less than a certain value which indicated that tremolite fiber was not detected by our x-ray method. The limit of detection for tremolite by x-ray diffraction technique is about 0.2%. When concentration factors were taken into consideration, the possible maximum tremolite content in each sample was indicated in the analyses.
4. Most of the Monokote showed undetectable tremolite content except #57, an MK-4 product used at Hyatt Regency in Dallas, which showed a 0.24% tremolite; the value has been double checked and is real.

Julie C. Yang
Julie C. Yang

JCY:mlr

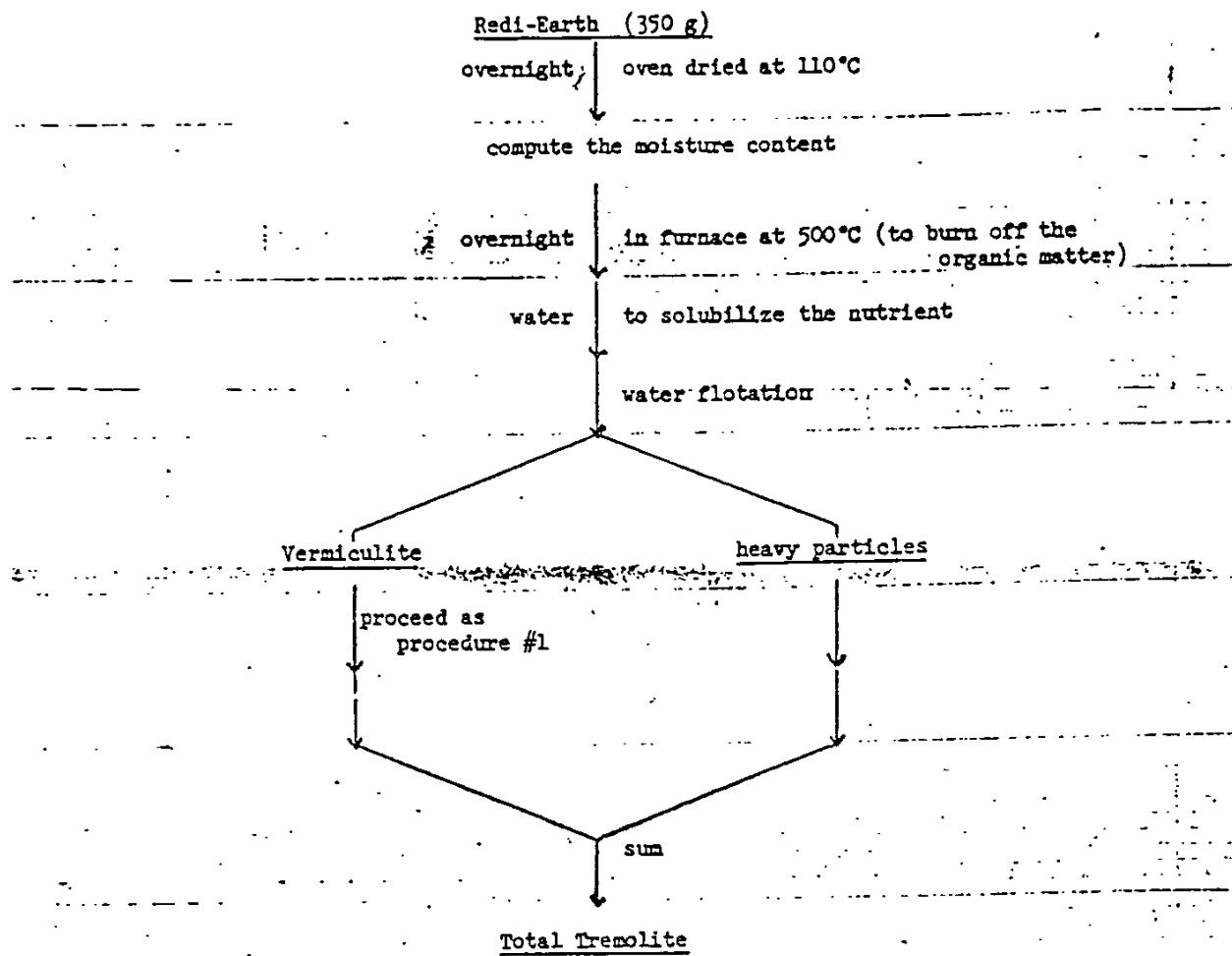
1. SCHEMATIC DIAGRAMS FOR TREMOLITE ANALYSIS

1. Tremolite Determinations in Terra-Lite Vermiculite



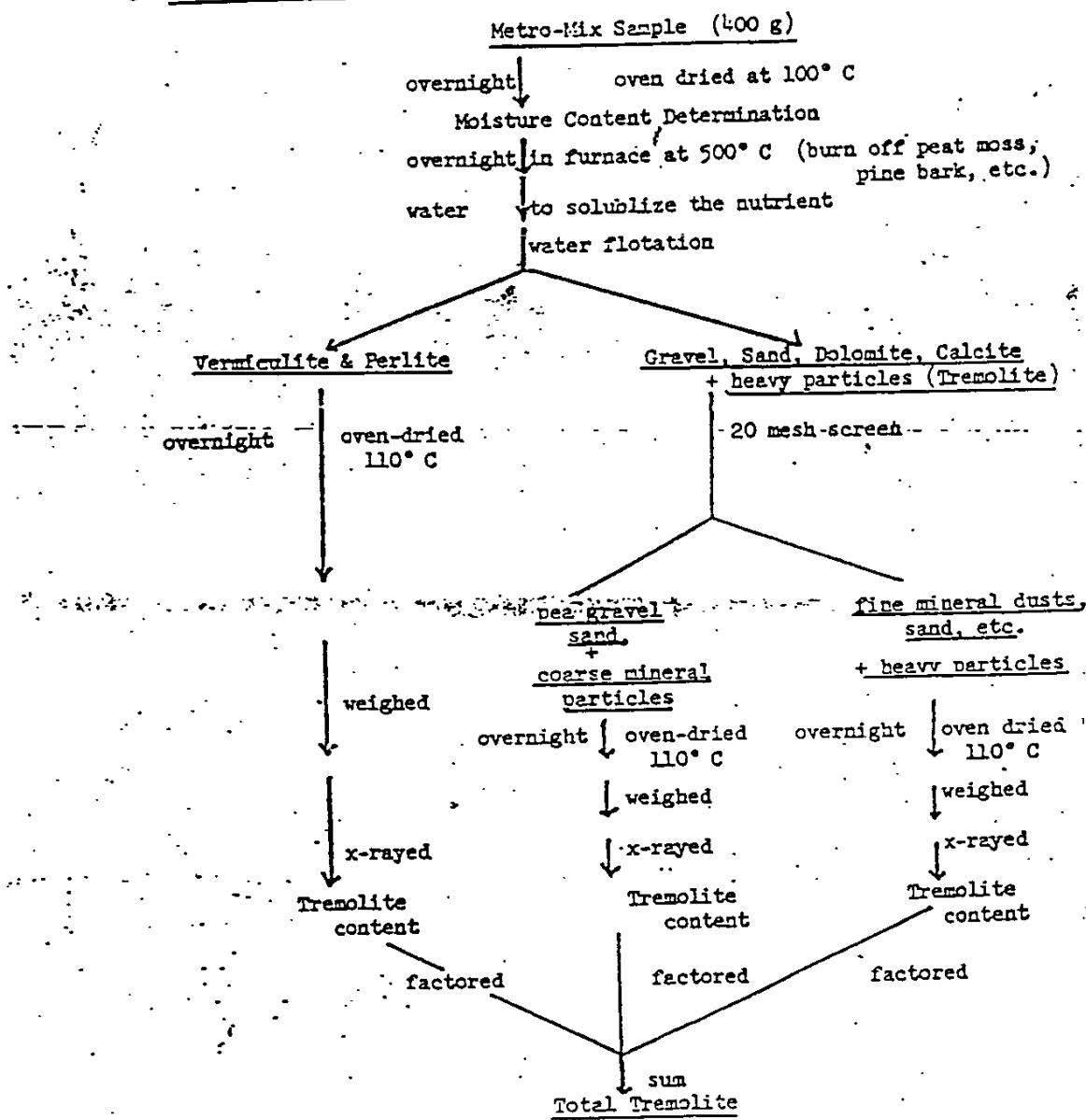
Julie C. Yang
April 19, 1977

2. Tremolite Determination in Redi-Earth



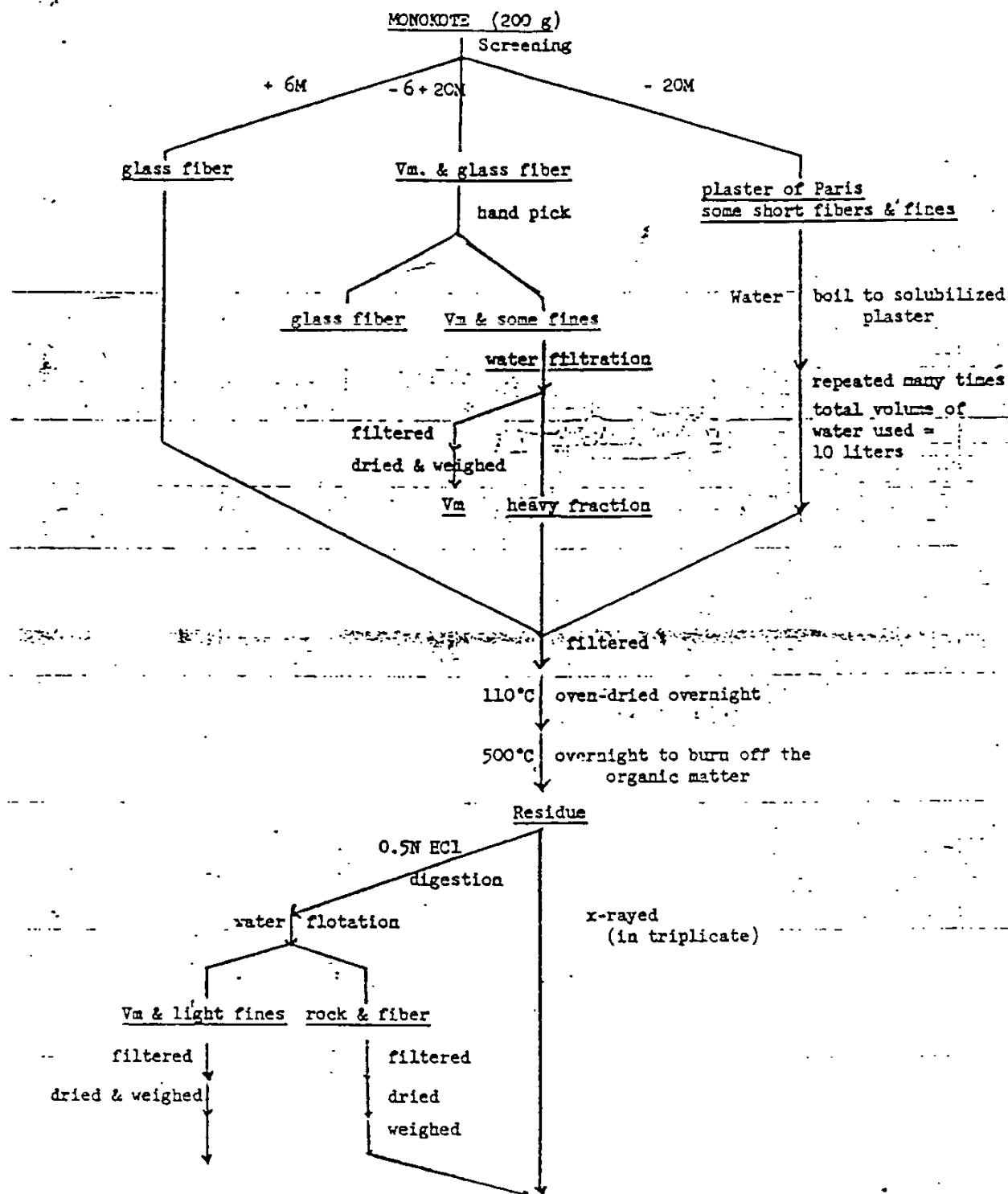
Julie C. Yang
April 19, 1977

3. Tremolite Determinations in Metro Mix



Julie C. Yang
April 19, 1977

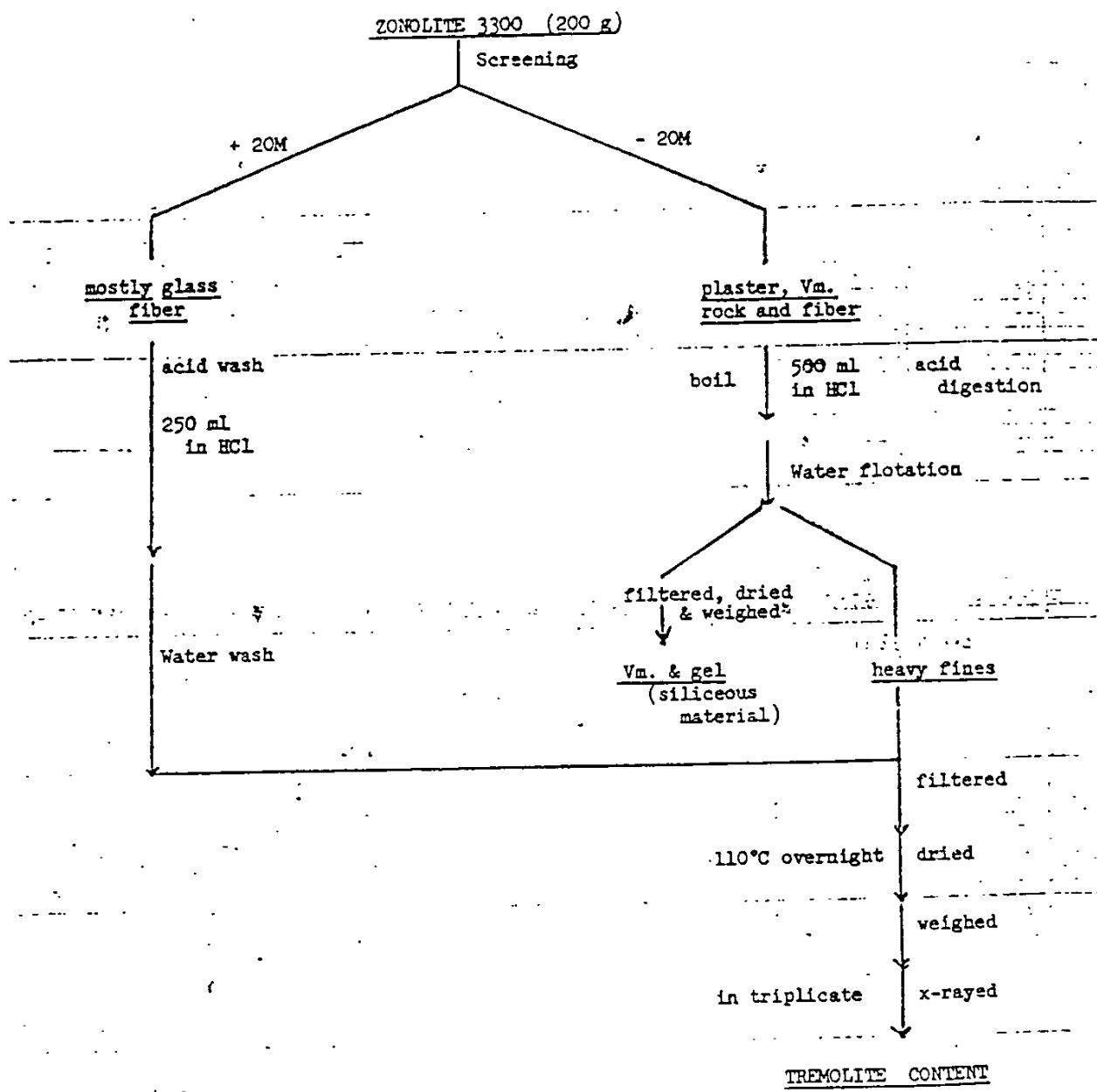
4. TREMOLITE DETERMINATION IN MONOKOTE



Julie C. Yang
April 19, 1977

TREMOLITE CONTENT

5. TREMOLITE DETERMINATION IN ZONOLITE 3300



Julie C. Yang
April 19, 1977

EXHIBIT E

GRACE

Construction Products Division

PERSPECTIVE AND CONFIDENTIAL

03629668

To: C. E. Brooks
C. N. Graff

May 24, 1977

From: E. S. Wood

May 24, 1977

Subject: Tremolite in Vermiculite

May 24, 1977

cc: R. M. Vining
H. A. Blasington
H. C. Duscher
M. R. Banion
W. P. McCord
L. Rosenblatt
B. N. Williams
J. W. Holter

May 24, 1977
The purpose of this memorandum is to discuss . . .
the tremolite problem as it impacts our vermiculite
business.

* * *

[former Libby employees'] risk of lung cancer is five
times the national average . . .

* * *

Based on the advice of corporate general counsel,
we have decided not to affix labels on . . . expanded
products using Libby ore . . .

* * *

Zonolite Profitability Impact . . . 10-50% reduction in
sales volume that would result from a requirement to
label our products . . .

* * *

Harm to customers . . . The highest level of
exposure is for Attic insulation [with] concentrations
of upwards of 15 f/ml . . . in simulated tests . . .

* * *

Product bans . . . We forecast that our vermiculite
consumer products, namely Attic Insulation . . . will
eventually be banned by the Consumer Products
Safety Commission . . .

* * *

A decision to label our consumer products would
eliminate the risk of future liability, while
exacerbating the risk of claims . . . from past use of
the product.

The purpose of this memorandum is to discuss in some
the nature of the tremolite problem as it impacts our vermiculite business,
and also to outline our plans for dealing with the problem. These plans
are based on extensive product testing, analysis of alternative config-
urations of the Zonolite business, and consultation with legal counsel,
including the Corporate Legal Division.

THE PROBLEM

Tremolite is present as a tramp mineral in our vermiculite
deposits, and while most of it is separated from the vermiculite in the
mining process, small amounts are carried to expanding plants and ul-
timately into finished products. Tremolite is classified as asbestos
and regulated by the Environmental Protection Agency (EPA), the Occupa-
tional Safety and Health Administration (OSHA), the Mine Enforcement and

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GRACE

Construction Products Division

PERSONAL AND CONFIDENTIAL

03629668

To: C. E. Brookes
C. N. Graf

From: E. S. Wood

Subj: Tremolite in Vermiculite

May 24, 1977

cc: R. M. Vining
B. A. Blessington
H. C. Duecker
W. R. Hanlon
W. F. McCord
L. Rosenblatt
B. R. Williams
J. W. Wolter

The purpose of this memorandum is to discuss in some detail the nature of the tremolite problem as it impacts our vermiculite business, and also to outline our plans for dealing with the problem. These plans are based on extensive product testing, analysis of alternative configurations of the Zonolite business, and consultation with legal counsel, including the Corporate Legal Division.

THE PROBLEM

Tremolite is present as a tramp mineral in our vermiculite deposits, and while most of it is separated from the vermiculite in the milling process, small amounts are carried to expanding plants and ultimately into finished products. Tremolite is classified as asbestos and regulated by the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the Mining Enforcement and

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Safety Administration (MESA), the Consumer Product Safety Act (CPSA), and the Toxic Substances Control Act (TSCA) as a carcinogen. Although we have been working since 1971 to reduce tremolite in our product, in our expanding plants, and in our mills, we have felt until now that tremolite was misclassified by OSHA and others as a form of asbestos. This was based on our understanding of the difference in physical characteristics of tremolite compared to other fibrous forms of commercial asbestos, as well as outside studies such as the animal study sponsored by Johnson & Johnson on a tremolite talc which showed no carcinogenicity.

Two recent developments have changed our views on this subject. First, an in-house study of mortality rates among ex-employees at Libby indicates that their risk of lung cancer is five times the national average. In this connection, we have experienced asbestosis in 41.5% of the workers (with over 10 years' service) in Libby, as well as in 28% of the workers (with over 10 years' service) exposed to Libby ore in the expanding plants. (The experience at Libby is confused because all of the aforementioned workers were exposed to high dust count levels in the old dry mill. The present Libby dust environment with the new mill represents a major change in this respect. Fiber counts have dropped from a level of above 30 f/ml on the average to a level below 5 f/ml. Also, the expanding plant employees mentioned have also been exposed to commercial asbestos in the manufacture of MK for a number of years.) Secondly, with respect to national safety regulations, the prior distinctions between "commercial asbestos" and "non-commercial asbestos" (tramp contaminants) are being erased as the general nature of the hazard of exposure to fibrous materials is more thoroughly studied.

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A great deal of controversy exists over what constitutes a safe level of exposure to a carcinogen. Most people would agree that safe levels are very difficult to establish. One view, taken by most regulating agencies, is that since no safe level can be unequivocally demonstrated, carcinogens must be eliminated where there are acceptable substitutes. Where the carcinogen cannot be eliminated by substitution, exposure must be controlled at the lowest level which can be technically achieved and reliably monitored. The opposing group makes a strong case that no unusual health risks have been rigorously documented for asbestos exposures below 5 f/ml (8-hour time weighted average), much less the present standard of 2 f/ml, or proposed standard of .5 f/ml. In the presence of such controversy it is difficult to determine what posture is appropriate for us in establishing limits of exposure for our employees and customers. A more detailed discussion of the health hazards associated with asbestos exposure is contained in Appendix I.

The exposure problems that we have seen to date are limited to the fibrous type of tremolite that occurs in the Libby deposits. The tremolite associated with our deposits in and around Enoree, South Carolina is largely non-fibrous. Since we have no evidence of asbestosis or other excess health risk associated with asbestos exposure among employees working in South Carolina, we do not believe that the levels of exposure to our employees or customers utilizing material from South Carolina creates a health hazard of any kind. In the case of material from Libby, we believe that lower levels of exposure are required to assure the safety and well-being of our employees. Moreover, regulations already proposed, when put into effect, will mandate lower levels.

C. E. Brooks/C. W. Gray

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PROPOSED ACTIONS

1. Fiber Control

As a result of the existing and expected regulations, we are moving ahead on a faster than planned schedule with requests for \$1,271,000 in fiber control capital spending originally budgeted through the end of 1978 for the Libby mill and various vermiculite expanding plants. We will also request authorization to spend \$298,000 over and above that which was budgeted, again principally for fiber control projects. The individual projects are listed in detail in Appendix II.

Insofar as fiber reduction is concerned, our experience to date indicates that removal of tremolite fibers at the mill is a preferred method of reducing employee and customer exposure levels. Immediate temporary steps have been taken to reduce the level of fines which have been recycled into the ore shipped from Libby. It is too early to assess the benefit of these changes, although taken alone they are not expected to eliminate the need for a fiber reduction program at the expanding plants and a fiber-binding program for consumer products. The cost of permanent equipment to collect and dispose of these fines is included in the overall Libby fiber reduction program discussed below.

The present MESA standard in effect at Libby is 5 f/ml (8-hour TWA). The Federal Metal and Non-Metal Mine Safety Advisory Committee has recommended that MESA lower the present standard to 2 f/ml, although the timing of such a change is uncertain. Our objective is to bring all Libby fiber counts below 2 f/ml by January 1, 1978. To meet this objective we will be proceeding with \$718,000 in capital spending over the next few months (budgeted

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at \$605,000 in the 1977 capital budget). Included in this amount will be \$331,000 of spending against RCA 12-2 (budgeted for this year at \$204,000) for mill-related fiber and dust segregation, collection and disposal equipment. The remaining \$387,000 (budgeted at \$401,000 for 1977) will be directed at mine area dust control and vehicular dust control equipment. Authorization for this spending is being requested under separate RCA's and shop orders.

For the long term, research is being carried on at North Carolina State, aimed at improved separation techniques that appear to be effective in clean-up of our finer grades (No. 3 and No. 4). Unfortunately, this approach does not seem to be effective for the coarse grades (No. 1 and No. 2) which are used almost exclusively for Attic Insulation (hence the need for a binder development for Attic Insulation). Laboratory scale results indicate that a reduction of over 90% in the level of fibrous tremolite in fine grades may be achievable. This would appear to be the preferred long-term solution to tighter fiber exposure levels both at our expanding plants and in the customer use environment for the greatest volume of our products (\$28.3 million out of a total \$35.5 million of expanded vermiculite sales and ore sales to outsiders using Libby ore in 1977).

A series of changes primarily in ore handling facilities will be made at eight expanding plants which do not presently meet the OSHA standard of 2 f/ml (8-hour TWA). These changes will total \$943,000 of capital as follows: Denver (\$50,000); Newark (\$114,000); Phoenix (\$110,000);

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Dallas (\$50,000); Portland (\$107,000); Dearborn (\$197,000); and Omaha (\$315,000). Since the steps taken to reduce fiber counts to 2 f/ml, with proper plant maintenance, can generally bring fiber counts below 1 f/ml with appropriate peripheral equipment, we expect to achieve a level of 1 f/ml at all expanding plants by mid-1978. An additional \$93,000 of capital will be required for peripheral equipment to meet 1 f/ml at the following plants: Easthampton (\$17,000); St. Louis (\$26,000); Little Rock (\$50,000). These changes will be handled through a series of individual plant RCA's or shop orders, with the exception of Omaha spending which has already been approved under RCA E76-317 (\$247,000 approved by the President on November 26, 1976), and RCA E76-311 (\$68,000 approved by the CFD President on September 27, 1976). Excluding Omaha, the expanding plant capital spending totals \$721,000 versus budgeted 1977 and 1978 figures totaling \$666,000.

In part, these changes are being undertaken now since they represent relatively small capital increments (above what would be required to reach the present mandatory levels) that will yield substantially lower exposure levels to our employees. However, it is clear that the levels which we propose meeting will eventually be embodied in stricter state and federal standards. Moreover, it is clear that the Federal Government policy for the long run will be directed to achieving the lowest level which is technically feasible and which does not have an adverse impact on the economy as a whole.

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Standards as low as 1 f/ml have been proposed by the National Institute for Safety and Health (NIOSH). While this was a proposal that has been made without regard for its economic impact or technical feasibility, it is indicative of the general philosophy behind control of substances defined as carcinogens.

2. Product Labeling

Based on the advice of corporate general counsel, we have decided not to affix asbestos warning labels on any of our expanded products which, in their normally intended use, do not expose customers to fiber levels above those permitted by OSHA. Thus, no products made from South Carolina ore will require labeling. Subject to the results of additional job-site tests, no present expanded products using Libby ore will require labeling, with the possible exception of industrial grades for which we may not be able to identify and test all end uses. This policy is consistent with the posture of Johns-Manville, the largest supplier of asbestos products in the U.S. and a leader in the field of asbestos safety and health precautions. Effective July 1, 1977, all new packaging purchased will include a general dust warning label printed on the package.

In the case of consumer products, we are operating under the presumption that the present controversy over regulation of materials containing asbestos will be resolved by the Consumer Product Safety Commission (CPSC) in favor of a complete ban on consumer products containing asbestos fibers unless they can be shown to be "bound". Recent action of the CPSC

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in proposing a ban on drywall joint compounds containing asbestos, artificial fireplace logs using free asbestos fibers, and spackling compounds containing tremolitic talcs tends to support our presumption of an eventual ban on unbound asbestos-containing consumer products.

Equipment is being installed at 14 key plants at a projected cost of \$130,000 (average of \$9,300 per plant) using individual, locally approved shop orders. This equipment will permit us to apply a binder for our two major consumer products -- Attic Insulation and Horticultural Vermiculite. Simultaneously with the installation of the equipment, we are in the process of choosing an appropriate binder and level of treatment with the objective of reducing the use exposure for these products to a level of 1 f/ml maximum exposure and .2 f/ml on an 8-hour time weighted average basis. These are levels chosen because we think they are technically achievable and are close (within a factor of 2) to the level which NIOSH proclaims to be the lowest level which can be reliably monitored.

It should be emphasized that these steps are being taken to comply with the extremely stringent projected regulations, and not because we feel that the use of these products creates a serious risk for consumers.

Considering the brief and irregular pattern of use, we do not believe that asbestos exposure from our products causes an increased risk of health problems. However, there is a fringe of expert opinion, most prominently and articulately represented by a well-publicized expert from Mt. Sinai (Dr. Selikoff) suggesting that even brief exposures, presumably at high levels, can later produce mesothelioma. Mesothelioma is a rare form

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of lung cancer linked to asbestos exposure. For this reason, and the expected stiff regulation of asbestos-containing materials in consumer products, we feel that it is prudent to develop a treatment for our consumer products, even though it is anticipated this will increase our cost of manufacture by up to 15%.

Even though we will not be labeling most of our products, we intend to notify customers who inquire that small amounts of tremolite are present in our end products with the exception of our mixed products. In the case of mixed products (MONOKOTE and soil mixes), tremolite is detectable only through the use of internally developed analytical procedures which require elaborate techniques not commonly recognized or employed in the scientific community for detection of asbestos. For this reason, we are taking the position with all but authorized government authorities that our mixed products are "non-asbestos" products. Obviously, in responding to government inquiries we intend to provide specific data, which we have, that identifies trace levels of tremolite even in mixed products. It is our belief, for purposes of the law, that the amount of fibrous tremolite present in our mixed products is de minimis.

Requests for written statements concerning the presence of asbestos in our products from customers will be answered by indicating that we have small amounts of tremolite present in the product and by referring them to the OSHA regulations covering asbestos-containing products.

C. E. Brookes/C. N. Graf

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ZONOLITE PROFITABILITY IMPACT

Comparative financial analyses have been completed for the present Zonolite business and several alternative configurations which could be forced by future regulatory activity and/or our ability to meet future fiber standards. The base case and alternative case assumptions and financial comparisons are presented in Appendix III. The following table summarizes key financial statistics for: 1.) the Zonolite 1977 budget and forecast, prepared in October 1976; 2.) a 1977 re-estimate completed in January 1977 reflecting adjustments to sales and gross margins based on the economic outlook at that time (used as the "base case" in Appendix III); 3.) a "most likely" future case reflecting additional capital spending for fiber control, additional costs for binder treatment in certain products, withdrawal of certain consumer products such as Attic Insulation in the U.S., and labeling of the remaining consumer products (Case B in Appendix III).

(\$000)	1977			1980		
	Budget	Base Case	Case B(1)	Budget	Base Case	Case B
Net Sales	\$65,719	\$63,495	\$57,303	\$92,639	\$92,281	\$80,232
Operating Profit	5,201	4,183	3,033	8,278	8,512	6,065
Profit After Tax	2,779	2,556	2,018	5,305	5,373	3,758
Total Capital Employed	\$31,573	\$30,891	\$29,937	\$37,613	\$37,215	\$34,328
% Return on TCE	9.0%	8.5%	7.0%	14.3%	14.6%	11.2%

(1) Case B presented in 1977 is for comparative purposes only. The full-year impact of assumptions in Case B would not actually be experienced in 1977.

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Our projections indicate that even with the loss of our consumer business (assuming the Canadian Attic Insulation business continues) Zonolite continues to be a viable business albeit at lower than forecasted returns.

More selective internal use of South Carolina ore in place of Libby ore can largely eliminate the 10-50% reduction in sales volume that would result from a requirement to label our products as containing asbestos. The reduction in sales from labeling is primarily the result of our being the first labeled product on a construction job site which would force contractors to comply with impractical OSHA regulations.

ALTERNATIVE APPROACHES

Considering the large potential liability that results from the sale of products that contain even a small amount of contaminant defined by the government as a carcinogen, it is reasonable to question whether there are alternatives to the proposed action. Our exposure to law suits cannot be ignored. In addition, we are forecasting a continued demand for no return capital to be invested in the business in order to meet increasingly tighter standards for asbestos fiber exposure, independent of whether a proven risk exists or not. Two obvious alternatives would be to seek divestment of the business or to close Libby and retrench to South Carolina where the health issues are minimal (but not eliminated).

Divestment of Zonolite has been considered in the past and been judged impractical. It is felt that no buyer could be found, capable of continuing to operate the business (with adequate capital resources) to give us an acceptable price for the business as compared to other alternatives.

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Closing of Libby and retrenching to South Carolina would require a drastic change in the basis on which the business is run. It is likely that we would be operating a regional business in the East, Midwest, and Southeast, rather than the present national business for Zonolite products. This alternative, if required, would be expected to produce a high return but substantially lower after-tax profits. For example, our projection for 1980 for a regional business, without Libby, shows after-tax profit of 2.6 million dollars giving a 15.2% return on the 17.2 million dollar Total Capital Employed. (This case is presented as Case C in Appendix III.) Large asset write-offs and interim operating losses would be incurred to convert to this regional business basis.

We now believe the most likely case for 1980, retaining Libby, but recognizing the possible loss of consumer businesses to be a 3.8 million dollar after-tax profit, generating an 11.2% return on 34.3 million dollars of Grace Capital Employed.

Our forecast indicates that continuing to operate Libby and continuing to conduct a national business is a preferred alternative unless large amounts of capital are required to meet drastically tightened asbestos fiber exposure levels. Our best estimate is that a 1 f/ml standard for Libby would require 3.6 million dollars of additional capital. A tightening of the OSHA regulations covering our expanding plants to a level of .1 f/ml would require 6 million dollars of additional capital. Based on our present assessment of what is technically required, a move to the standards of .1 f/ml in the expanding plants and 1.0 f/ml in Libby would make it uneconomical to continue operating Libby.

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In the absence of such extreme (and unlikely) tightening of standards, our projections indicate that the best course is continued operation of Zonolite from two mine locations.

RISKS

There are seven specific risks associated with tremolite in our workplaces and products which we assess as follows:

1. Harm to customers.

We do not feel that our products create a hazard for normal end uses. The highest level of exposure is for Attic Insulation and Masonry Insulation. The high concentrations of upwards of 15 f/ml (15 minute maximum) for Attic Insulation and 12 f/ml (15 minute maximum) for Masonry Insulation that were observed in simulated tests early in 1976 have not been confirmed by the results of more recent testing in actual field use. (The present OSHA ceiling limit is 10 f/ml for any 15 minute period.) The maximum concentration in the case of Masonry Insulation observed in recent testing was 3.65 f/ml (15 minute maximum) and in the case of Attic Insulation was 4.28 (15 minute maximum). However, we have observed very large variations in simulated test results such that further improvement in Attic Insulation, in particular, may be necessary to be assured that we reliably fall below 10 f/ml maximum exposure during use. Due to the products' short and irregular periods of use, it seems unlikely that we would exceed the 2 f/ml, 8-hour time weighted average, OSHA standard with Attic Insulation or Masonry Insulation.

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All other products appear to be well below permitted levels, in most instances by a good margin. (See Appendix IV for representative test results.)

2. Harm to employees.

The present level of exposure for our Libby employees (up to 5 f/ml TWA), while materially better than the harmful exposures before the new wet mill, still represents concern to us. Therefore, we will be undertaking an employee education program as well as further reduction in the fiber levels to 2.0 f/ml, in order to reduce the risk of harm to our Libby employees' health.

The reduction to 1 f/ml in the expanding plants, which we expect to accomplish by mid-1978, should give us a comfortable margin of safety in concluding that there is very low risk to our employees in the expanding plant work environments.

The risk to expanding plant employees using South Carolina ore, as well as to the mine/mill employees in South Carolina, is negligible.

3. Product bans.

There is a high risk that our products will be banned in several significant uses.

We forecast that our vermiculite consumer products, namely Attic Insulation, Horticultural Vermiculite, and Pool Base, will eventually be banned by the Consumer Product Safety Commission, and this has been assumed in the 1980 financial projections (Appendix III). We place our chances at 50:50 of binding the tremolite such that we could effectively argue that no fibers will be released during use.

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There is also a high risk (30%) during the next 18 months that MONOKOTE fireproofing will be considered to fall within the ban in selected states (California, New York, Minnesota, Massachusetts, and Illinois) of fireproofing products containing asbestos, although it would appear that this is an unintended ban. Legislators in those states simply failed to consider trace tramp minerals when wording the prohibition against a product containing any asbestos for sprayed applications. We are actively working on a vermiculite free fireproofing material for introduction in mid-1978.

4. Label requirements.

We believe that a decision to affix asbestos warning labels to our products would result in substantial sales losses. This view is shared by Johns-Manville in the case of their labeled construction products. It is further supported by J-M's experience with their tremolite talcs.

Based upon advice from corporate counsel, our products do not require labels if the OSHA limits are not exceeded in their intended use. This is also J-M's position for their own products. We believe that all of our products fall below the limits established by OSHA and that we will be able to continue to fall below more stringent standards being projected, thus avoiding the need to label our products.

Secondly, any change in interpretation which would require a labeling of selected products, such as Masonry Insulation, can probably be avoided by redistribution of the cleaner South Carolina ore and withdrawal from selected isolated territories.

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Continued programs aimed at cleaning up the product should allow us to meet the projected tighter limits that may be imposed by OSHA in 1978 and 1980.

5. Increasingly restrictive standards and higher capital requirements to meet the more stringent future standards.

We believe there is a very high risk that standards will become more restrictive requiring additional capital for continued operation of Libby and of expanding plants using Libby ore. In addition to the 1.9 million dollars which we propose to spend between now and mid-1978 to comply with asbestos fiber safety standards, an additional one million dollars is expected to be needed by 1980 in order to meet a projected OSHA standard of .5 f/ml.

There is a risk, which we place at less than a 20% chance, that additional investment of up to 10 million dollars would be required in order to reach a level of 1 f/ml at Libby (\$3.7 MM) and .1 f/ml at expanding plants using Libby ore (\$6.3 MM). Such a development would probably result in a decision to close Libby and the retrenchment of our business to a regional basis supplied entirely out of South Carolina. (See Appendix III, Case C for details of the financial impact of a decision to close Libby.)

6. Adverse publicity

There is a risk that Grace will attract adverse publicity from national media concerning the presence of asbestos in vermiculite. This

C. E. Brookes/C. N. Graf

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information is already being circulated within government agencies, such as OSHA and has been reported on a local basis in connection with the Louisa County dispute over the mining of vermiculite ore. Future steps, such as the development of a case for continued sale of Attic Insulation to the Consumer Product Safety Commission, will increase the risk of widespread adverse publicity.

7. General liability to employees, customers, and the public.

Liability to employees is limited by the Workmen's Compensation Laws. However, we should expect increased Workmen's Compensation rates in Libby as the number of disabilities increase among employees who have been exposed in the past to the high fiber concentrations of the old dry mill. Liability among expanding plant employees and the South Carolina mine/mill employees appears minimal.

The risk of liability to customers is heightened by the decision not to label our products. Under the strict liability criteria, we may be liable to customers who can demonstrate they (1) were exposed to asbestos fibers and (2) sustained personal harm. Based on advice of corporate counsel, this risk is categorized as moderate. Moreover, it seems unlikely that bona fide cases of personal harm could be well documented considering the pattern of use and exposure levels of our customers.

General public liability, stemming from the sale of consumer products, is a low-level risk with very high potential liability if it develops. While we have no evidence of any adverse effect of our products on consumers, neither can we offer convincing evidence that they are ab-

C. E. Brookes/C. N. Graf

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solutely safe. Making such a case is handicapped by the number of "experts" who claim that there is no safe level with the inference that any exposure is potentially hazardous. This leaves us open to liability without a good defense over a broad range of alleged hazards. A decision to label our consumer products would eliminate the risk of future liability, while exacerbating the risk of claims (mostly not bona fide) from past use of the product.

E. S. Wood

ESW/CGR
Attachments

03629685

APPENDIX I

MEDICAL EVIDENCE ON THE EFFECT OF ASBESTOS EXPOSURE

Exposure to high concentrations of asbestos fibers results in increased risk to health of three different types:

Asbestosis is a scarring of the lungs that is a chronic condition appearing first in chest x-rays, usually after 5 or more years of exposure. It can be reliably diagnosed from x-rays and is specifically identified with exposure to asbestos fibers.

Lung cancer (bronchogenic carcinoma) can develop as a result of exposure to asbestos fibers or to other causes (such as smoking). It is difficult to diagnose due to the long latency period between initial exposure to asbestos and development of symptoms. Furthermore, since there are a number of causes of lung cancer, it is more difficult to establish a cause-effect relationship between exposure to asbestos fibers and lung cancer. Nonetheless, a great deal of work has been done which convincingly indicates a relationship between an excess risk of lung cancer and exposure to high concentrations of asbestos (above 5 f/ml). A combination of exposure to high concentrations of asbestos fibers and smoking is more damaging than either alone. One study among asbestos workers has shown that smokers have eight times the risk of lung cancer than non-smokers have.

Mesothelioma is a rare form of cancer which can occur either in the lungs or in the stomach. It can be specifically diagnosed only by taking a biopsy of the affected organ. It is specifically associated with asbestos exposure. Around 85% of cases diagnosed as mesothelioma occur in patients who have a history of exposure to asbestos.

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Although there is disagreement between experts on this point, the determination of an increased risk of asbestosis may also be indicative of an increased risk of lung cancer.

For purposes of assessing the risk to our employees, the only practical indicator is the incidence of confirmed cases of asbestosis. This is due to the extreme difficulty of determining the cause of cancer in any group of people considering the long latency period and general lack of specificity between lung cancer and any single cause. The exception to this would be cases of mesothelioma. However, we have no reports of mesothelioma even at Libby.

As a result of the particular philosophy employed by government agencies to regulate carcinogens, as well as the experimental difficulty of establishing safe levels, very little scientific work is available to help identify the health risk posed by exposure to low levels of asbestos fibers (under 5 f/ml).

There are three sources of information outside CPD which purport to indicate that asbestos fibers cause increased health risks even at low concentrations.

The first is a study among hard rock miners in Idaho (Gillam et al.) which indicates an increased risk of lung cancer in the presence of asbestos fiber exposures of around 0.24 f/ml. However, this study is confounded by the presence of other potentially carcinogenic materials, notably arsenic-containing compounds and radon daughters. A still unpublished study of a larger group of the same miners (McDonald et al.) has indicated no increased

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mortality risk from silicosis. This particular evidence of a hazard associated with low level exposures would seem to be seriously impugned.

A second purported indication of the hazard associated with low exposure levels is an increased risk of lung cancer among relatives of asbestos miners. However, more recent measurements indicate that fiber exposures in home environments of asbestos workers can be high and therefore this probably does not represent a low level exposure environment.

The third collection of evidence is of mesothelioma (not other asbestos-related diseases) in individuals and in animals exposed to high concentrations for brief periods of time (as little as 8 hours). The cases in men are few in number typically involving one or two individuals with unknown but probably very high exposure concentrations. Due to the small number of cases, definite cause-effect relationships cannot be drawn. The cases among animals are at extremely high dosage levels in species which are especially sensitive and, therefore, extrapolation to the effects on man are not well-founded.

In spite of the lack of hard evidence, there is a respected group of professional researchers who express the opinion that exposure to levels as low as 2 f/ml (8-hour TWA) create an increased risk of cancer in man after 30 or more years of exposure.

Results of our own in-house epidemiological studies indicate that conditions which existed in the old dry mill in Libby (34 f/ml TWA) and in unregulated expanding plants using Libby ore (29 f/ml TWA) created a health hazard to our employees. Among present employees with 10 or more

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years of service who would have been exposed to the conditions in the old Libby dry mill, 41.5% exhibit asbestosis. Moreover, there is a five-fold increased risk of lung cancer among retired and ex-employees who worked in the Libby mine (as compared to the general population).

We are encouraged by the absence of any new cases of asbestosis found at the last annual check-up at Libby.

Among expanding plant employees, the high employee turnover and variety of past exposures make conclusions difficult. Among 9 employees with 10 or more years' service in plants which have not used Libby ore, there is no incidence of asbestosis, even though several of these plants have previously used commercial asbestos in some products. Among 14 employees with ten or more years of service in expanding plants which have used Libby ore, 28% exhibit asbestosis. However, any cause-effect conclusions are confounded by the fact that all of these plants have used commercial asbestos in the past.

Chest x-rays for the 77 employees at our Enoree mine/mill give no indication of adverse health effects from exposure to the lower level of tremolite fibers (0.8 f/ml) found in South Carolina. While there is incidence of positive chest x-rays in 12 employees (16% of total), only one case is consistent with exposure to asbestos. That particular employee worked for a great number of years exposed to commercial asbestos in another Zonolite location. Of the 12 positive chest x-rays, 5 stem from previous cotton spinning mill exposure which produces "brown lung" disease. There is no indication of excess mortality due to lung cancer among the South

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Carolina mine employees. Since the South Carolina mine has only operated for 29 years, there is still the possibility of extremely long latency periods before excess mortality would be observed.

As very little published medical evidence exists for tremolite exposures, as opposed to the commercial forms of asbestos, we have sponsored animal studies on tremolite and a mixture of vermiculite and tremolite to determine whether tremolite is carcinogenic. The test animals have concluded 400 days of treatment and are scheduled to terminate after 730 days. While no definite conclusions can be drawn from the results to date, indications are that our tremolite creates less of a problem than commercial asbestos. As we have not yet completed the "critical" period of the animal studies, between 370 and 450 days, the lack of a significant difference in mortality between the test animals and the control group is not yet meaningful. Results of this study should be complete and available by October 1978.

We have sought and obtained advice from several outside professionals with respect to what tremolite levels create a hazard.

Dr. William E. Smith of Fairleigh Dickinson University has responded (Appendix V), indicating that notwithstanding the "new evidence" presented by OSHA and NIOSH there is no convincing evidence of an excess risk to health from low level asbestos fiber exposures (below 5 f/ml).

Dr. MacMahon, Professor of Epidemiology at Harvard University, has questioned the conclusions of a leading epidemiologist, Dr. Selikoff of Mt. Sinai, that exposures to low levels are potentially hazardous. More-

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over, he indicates that an unpublished study of shipyard workers in the Pearl Harbor Navy Yard who have been tracked since 1943, indicates no excess risk of cancer mortality contradicting the evidence presented by Selikoff. He derides Selikoff's statements with respect to low exposure level hazards as being unprofessional and not well-founded scientifically.

Dr. Enterline of the University of Pittsburgh has proposed a mathematical model which closely fits the observed relationship between mortality rate and time of exposure among the group of 17,000 shipyard workers studied by Selikoff. We are in the process of using this model to predict the effect of exposure levels of 1 or 2 f/ml. Even assuming that tremolite fibers are as biologically active as commercial chrysotile asbestos (an unduly pessimistic assumption), preliminary indications are that the increased mortality risk from lung cancer as a result of a 50-year exposure to 2 f/ml is only 10% above those not exposed to asbestos fibers.

Discussions with Johns-Manville revealed that two "modern" asbestos fabricating plants (one in Texas and one in California), built in 1956-57, show no cases of asbestos-related disease among their employees. Exposures at these plants have been consistently below 10 f/ml (8-hour TWA), probably in the 2-5 f/ml range, with exposures during the 70's consistently below 2 f/ml. This suggests no excess health risk at concentrations up to 5 f/ml (8-hour TWA).

Amidst such conflicting scientific opinion, any conclusions which we draw must necessarily contain large elements of personal judgment and at least some level of uncertainty. Nevertheless, we must establish levels of

APPENDIX I

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03629691

exposure calculated to protect both employees and customers from excess health hazards. Accordingly, we have concluded that in a regulated and monitored environment such as our plants, a reduction in exposure to 1 f/ml creates a worthwhile margin of safety over the present OSHA standard of 2 f/ml for our employees. A level of 1 f/ml is not expected to have an adverse health effect. A level of 2 f/ml, while probably not hazardous, does not have an acceptable margin of safety and will be reduced if economically feasible. No customers or employees will be exposed knowingly to concentrations above a level of 2 f/ml without adequate warning of the potential hazards involved. Johns-Manville also selects 2 f/ml as a limit below which there is "no excess risk of asbestos-related disease" (compared to those who are not exposed to asbestos).

In unmonitored environments, involving daily use of our products, such as construction sites, a typical exposure from our products of .5 f/ml (TWA) is not considered a hazard.

With the exception of mixed horticultural products, exposure levels for users of our product are above background levels. It is not likely that any improvement which we may make will reduce the exposure of users to levels as low as background. However, our long-range objective will be to reduce customer exposure levels to "the lowest limit at which asbestos fiber concentrations can be reliably monitored". According to NIOSH, this level is .1 f/ml on an 8-hour time weighted average basis and .5 f/ml for any 15-minute period.

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APPENDIX II

CAPITAL SPENDING SUMMARY
TREMOLITE FIBER COMPLIANCE
 (\$000)

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	<u>Capital Amount</u>	<u>Capital Budget 1977</u>	<u>1978</u>
<u>Expanding Plants - OSHA @ 1.0 f/ml & 5.0 f/ml</u>			
Denver - Ore Handling	\$ 50	\$ 80	\$ 85
Newark - Ore Handling	114	80	
Phoenix - Ore Handling	110		85
Dallas - Dust Cont. on MK and SM	50	35	
Portland - Ore Storage & Handling	107	101	
Dearborn - Ore Storage & Handling	197	192	
Easthampton - Rock Handling	17	18	
St. Louis - Vent System	26	33	
Little Rock - Ore Handling	50	37	
TOTAL EXP. PLANTS - OSHA	<u>721</u>	<u>496</u>	<u>170</u>
<u>Expanding Plants - Product Binder Equipment</u>			
14 Plants @ \$9,300 per plant	\$ 130	-	-
<u>Libby - To Achieve 2.0 f/ml^(a)</u>			
<u>Mill</u>			
RCA #12-2	331	204	
<u>Mine</u>			
	225	225	
<u>Hauling & Loading & Screen Plant Trucks</u>			
TOTAL AT LIBBY	<u>162</u>	<u>176</u>	<u>-</u>
TOTAL SPENDING	<u>\$ 718</u>	<u>\$ 605</u>	<u>\$ -</u>
	<u><u>\$1,569</u></u>	<u><u>\$1,101</u></u>	<u><u>\$ 170</u></u>

(a) See page 2 for Libby detail.

GRACE

Construction Products Division

03629693

PERSONAL and CONFIDENTIAL

March 28, 1977

To: W. R. Hanlon H. A. Eschenbach
B. R. Williams W. F. McCord
J. W. Wolter R. C. Abernathy
W. R. Wright R. R. Benanto
R. E. Schneider H. C. Duecker
F. W. Eaton B. A. Blessington
R. H. Locke

From: E. S. Wood

Subj: Guidelines for Handling of Tremolite Contamination
In our Mines, Plants, and Products

cc: R. M. Vining
L. Rosenblatt
W. M. Bush, Jr.
O. M. Favorito
R. L. Oliverio/Libby

Plans have now been laid for handling a variety of external developments related to tremolite asbestos in our mines, expanding plants, products, and customer environments. We must now proceed to implement some of the work plans which have been developed.

Please plan to attend a meeting at 8:30 AM in the Directors' Conference Room on Thursday, March 31st. The purpose of this meeting will be to discuss what actions we will be taking over the next twelve months.

By way of background, you should know our position on several important legal and business issues. The following are three key points:

1. We will not expose our customers and employees to environments which have been formally defined as hazardous by the U. S. Government without proper caution as to the nature of the hazard. We will take all reasonable and practical steps to minimize or eliminate unreasonable risks which may be associated with the manufacture and use of our products including, where appropriate, instructions for proper use of our products.

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To list
Subj: Guidelines

-2-

March 28, 1977

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2. The tremolite asbestos fiber count limits in effect and enumerated in OSHA (or MESA) regulations will be the guide to whether a health hazard exists. If the product in reasonable use exposes the user to counts in excess of OSHA limits, caution labels will be affixed to the product.
3. Customer, user, or government agency inquiries with respect to tremolite in our plants, products, or use environments will receive straightforward and candid responses with respect to the data and measurements which we have gathered and which are relevant to their respective situations.

As you know, there is a great deal of controversy both in the medical and governmental communities as to what constitutes a hazard and what appropriate regulatory steps should be taken. This is particularly true for products used by consumers. We have reason to believe that this issue will be clarified by the Consumer Products Safety Commission within the next several months. By that time we want to have any tremolite asbestos fibers in our consumer products "bound" and fiber counts in their intended use below 0.2 f/ml (8 hr TWA) and 1.0 f/ml (15 min. maximum). You should be aware that this is a rapidly changing situation and that requirements are still unpredictable.

Attached is an agenda for our meeting of Thursday, March 31st.

Clip
E. S. Wood

ESW/CGR
Attachment

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AGENDA

for

Thursday, March 31, 1977

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1. Legal and Medical Issues

- a. CPA
- b. OSHA/MESA
- c. General Obligations

2. Continuing data gathering requirements and responsibilities

- a. Plants and mines
- b. Users
- c. "No asbestos" case for MONOKOTE vs. Glass Fibers in key states

3. Financial and engineering requirements/work plans

- a. Immediate and short-term -- authorized to proceed
 - (1) Water treatment for Terra-Lite Vermiculite and Attic Fill
 - (2) Remove and dispose of "fines" at Libby
 - (3) Define cost (capital and operating) and effectiveness of binders for AF, TV and MF
 - (4) Determine effectiveness of air elutriation by pilot trials
 - (5) Engineering design for items in b.

b. Appropriations to be justified and requested:

- (1) Installation of permanent binder addition equipment in expanding plants
- (2) Get all expanding plants to 2.0 f/ml (8 hr TWA) by 1/1/78

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AGENDA (continued)

2.

(3) Get Libby to 2.0 f/ml (8 hr TWA) by 1/1/78
(4) Get all expanding plants to 1.0 f/ml (8 hr TWA)
by 7/1/78.

4. Customer, governmental, and media communications

a. Grace policy on comments to media -- DON'T DO IT,
LET NY HANDLE, -

b. Responsibility and guidelines for customer and govern-
mental communications

(1) Salesmen and plant managers -- verbal communications

(2) Product and Q.C. managers -- routine written customer
and governmental communications covered by guidelines

(3) General Sales Managers -- unusual governmental and
customer communications covered by guidelines

(4) Exec. VP -- any communication not covered by guide-
lines.

5. R&D Work Plans

a. Vermiculite free substitutes

(1) MONOKOTE

b. Modifications for commercial use

(1) MF treatment to 1.0 (TWA); 5.0 (Max.)

(2) AF treatment to 0.1 (TWA); 2.0 (Max.)

(3) TV treatment to 0.1 (TWA); 2.0 (Max.)

(4) Thin ZIC RD design

(5) Bark ash sources for MM products

(6) 3300 for high humidity urethane foam fireproofing

(7) External fireproofing

(8) Other?

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AGENDA (continued)

3.

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- c. Modifications to have "on the shelf"
(1) Vermiculite free Redi-Earth
(2) High yield (200% on vermiculite) ZIC
(3) Glass free MONOKOTE for decks
(4) Vermiculite free MM.

6. Document Contingency Plans

- a. Remaining air and product assay samples
- b. Revised customer and press releases.
 - (1) MONOKOTE withdrawal
 - (2) AF withdrawal
 - (3) AF labeling
- c. Financial Impact Cases
 - (1) Eliminate inconsistencies
 - (2) Document and issue summaries
 - (3) Additional years?

APPENDIX II

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DETAILS OF LIBBY FIBER REDUCTION SPENDING

	<u>Capital Amount</u>	<u>1977 Capital Budget</u>
<u>MILL</u>		
<u>RCA #12-2</u>		
Final Cleaner System 20 x 65	\$100	\$ 90
Modif. of Dryer Cyclone & Disp. System	40	
Wash & Screen Hammermill Product	25	
Skip Dust Collection	55	55
Screen Plant Baghouse Disposal	20	
Dust Disposal at Mud Dam	10	
Screen Plant Truck Dump Disposal	12	12
Screen Plant Shuttle Truck Dust Collection	12	
Screen Plant Control Room & Conveyors	11	11
Dust Wall - Transfer Point	3	3
Permanent Dust Disposal from Dryer BH	10	
Mill Lab Vent	5	5
Rework Dryer Belt BH System	20	20
Seal Between Dryer & Wet Mill	8	8
<u>TOTAL MILL</u>	<u>\$331</u>	<u>\$204</u>
<u>MINE</u>		
Paving - Garage Area	50	50
Paving - Transfer Point Area	50	50
Revamp Mobile Equip. Air. Cond.	75	75
Dust Control - Drills	20	20
Mine Vacuum Station	10	10
Wash Rack - Garage Area	20	20
<u>TOTAL MINE</u>	<u>\$225</u>	<u>\$225</u>
<u>HAULING, LOADING, MISC. VEHICLES</u>		
Temporary Dust Truck & Hopper	\$ 15	\$
Screen Plant Super Sucker	10	
Haul Truck Enclosures	22	22
Dust Control - Load Out	15	15
Permanent Dust Disposal Truck	100	
<u>TOTAL</u>	<u>\$162</u>	<u>\$ 37</u>
Unidentified Projects		<u>139</u>
<u>TOTAL LIBBY @ 2.0 f/ml</u>	<u>\$718</u>	<u>\$605</u>
	<u>=====</u>	<u>=====</u>

APPENDIX III

GRACE

Construction Products Division

03629699

TO: E. S. Wood
FROM: R. R. Benanto
CC: Distribution List

May 6, 1977

SUBJECT: Zonolite Study -
Financial Impact of
Contingency Plans

The following pages summarize the assumptions, and financial impacts of the various case assumptions developed during the Zonolite Contingency planning study performed in March. For each case, the impact on the following areas are presented:

- 1.) Overall case assumptions
- 2.) Market & Product Impacts
- 3.) Impact on Mines & Ore Allocation
- 4.) Expanding & Polystyrene Plant Impact
- 5.) Selling Expenses
- 6.) Capital Spending
- 7.) Summary of Financial Implications

All cases are compared to the Zonolite "Base Case" in 1977 and 1980. The "Base Case" reflects the 1977 Budget & Forecast adjusted for the re-estimate in BPD/ Ag sales and margins made in January, 1977.

Ron

R. R. Benantq

RRB:mhr
Att.

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CASE A - Major Labelling Program and Withdrawal of All Consumer Products

I. Overall Case Assumptions

- A. Fiber Counts to 1.0 OSHA (12/77) and 2.0 MESA (12/77)
- B. Withdraw all Consumer Products
- C. Lose Canada
- D. Label all Libby Products except ZIC, MK, and Mixed Horticultural.

II. Market & Product Impacts

A. Withdrawal

Withdrawal from the Attic business results in simultaneous withdrawal of all Glass Fiber sales and a significant impact on dealer Plainboard sales (ranging from 20% loss in 1977 to 31% in 1980).

Withdrawal from Horticultural Consumer market results in total loss of consumer Terra-lite and mixed product sales. These consumer sales losses are partially offset by increases (20% in 1977 and 30% in 1980) in horticultural perlite sales to consumer through substitution of perlite.

B. Labelling

Only products produced from Libby ore would be labelled. The estimated impact of labelling products varies from product to product and is summarized as follows:

Masonry Fill - 20% drop in volume in 1977 and continued declines of 10% per year until by 1980 the volume is only 50% of 1977 volume.

Plaster Ag - 50% drop in 1977 and another 50% drop in 1978 so that by 1980 the volume is only 25% of 1977 volume.

Misc. Expanded - An immediate drop of 10% in 1977, but a gradual rebound in volume of 4% per year so that by 1980 Misc. Expanded volume is only 2% off of the Base Case.

Ag Bag & Bulk - Declines from 30% off of Base Case volume in 1977 to 70% below Base Case volumes in 1980.

Terralite (Professional) - Decline of 50% in 1977 and an additional 20% off of 1977 volume by 1980. However, this impact is also partially offset by improved Horticultural Perlite sales to the professional market (20% in 1977 and 30% in 1980) and a 10-15% increase in non-labelled Horticultural Professional mixes (eg. Metro-mix). The latter favorable impact results from additional substitution of vermiculite with perlite and mixed products.

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C. Ore Sales

Licensees - Demand reflected downward, particularly in coarse sizes, to reflect their withdrawal of Attic Fill. Finer size demand was left unchanged (primarily MK and ZIC) with the exception of a slight overall negative impact due to Masonry Fill.

Independents - Unchanged.

Scott - Due to Scott's desire to avoid labelling Turf-Builder, Scott demand would fall by 30% in 1977 and continue to decline to 20% of Base case levels by 1980. The basic assumption here is that Scott would attempt to maintain their "natural" image and avoid labelling by substituting as much South African or Virginia Vermiculite ore as they could obtain. In addition, Scott has the ability to convert to a polyurethane process as a substitution and already produces such a product with an existing plant.

Gypsum Companies - Labelling impact reflects a 5% reduction in demand from 1977 to 1981.

Canada - Loss of all Canadian ore shipments precipitated by their withdrawal from Attic Fill.

III. Impact on Mines & Ore Allocation

In order to minimize the impact of lost sales due to labelled products made from Libby ore, the ore allocation plan reflects a maximization of the South Carolina mine output. Virtually all Masonry Fill demand was shifted to be supplied by South Carolina (except for Portland), so that the labelling impact on Masonry Fill in Case A was minimized. However, this required the transfer of approximately 23,000 tons to S.C. from Libby, in 1977 and over 26,000 tons by 1980. By 1980, the shift in Masonry Fill alone brought Enoree's output to 135,000 tons, or full capacity. Although some Ag Bag & Bulk & Terra-lite could be temporarily transferred from Libby to S.C. until 1978, for consistency, the 1977 volumes reflect only transferring Masonry Fill. Masonry Fill was chosen as the primary beneficiary of the ore allocation switch based on its more favorable margin contribution per ton of ore versus Ag Bag & Bulk, the extent of the impact on Masonry Fill due to labelling, and the amount of Masonry Fill currently being supplied from Libby.

South Carolina mine volume is reflected at 120,000 tons in 1977 (versus 96,000 tons in 1977 Budget) and in 1980 is at full capacity of 135,000 tons. Actually it becomes capacitated in late 1978. Overhead levels have not been adjusted at Enoree and its DMC is assumed to stay at Budget & Forecast levels. The most favorable impact at Enoree is the impact of the additional tonnage on depletion.

Libby volume is dramatically affected under the Case A allocation scheme. From a 1977 Base Case of 229,000 tons, Libby loses the following volumes: 34,500 tons of Canada, 23,000 tons of Masonry Fill shifted, 16,000 tons of Attic Fill, 8,000 tons lost to Scott, and 22,500 tons lost due to labelling. Libby's Case A 1977 volume is 125,000 in 1977 and 128,000 tons in 1980 (volume growth in non-labelled products is offset by continuing impact of volume lost due to labelling).

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At these low volume levels, it was estimated that Libby's DMC would still be able to remain at the \$26.50/ton budgeted level of DMC. However, fixed overhead expense reductions were not sufficient to offset Libby's gross margin loss due to volume and resulted in net-income after-tax losses of approximately \$750,000 in 1977 and 1980. However, even with these operating losses, Libby would generate approximately \$750,000 to \$1,000,000 in cash from operations for these years before any capital expenditures, which would be minimal due to the low volume levels. Libby would not receive any depletion credits in these years under these circumstances.

In order to operate at such low volume levels, Libby would be forced to operate the mill on a 4-day week for 37 weeks of the year and would be shut down for 15 weeks during the year. This analysis did not account for other potential negative affects caused by the resultant high turnover of management and skilled personnel that would likely follow from such an operation.

Overhead Expense Levels would be reduced by \$886,000 in 1977 as follows:

Factory Overhead	- \$622,000	- Reduction in the Overhead Dept. (\$366K) depreciation (\$47K), non-standard expense (\$78K), and mine and mill supervision (\$100K).
G&A	- \$145,000	- Reductions in engineering and clerical headcount.
R&D	- \$119,000	- Reduction in Prospecting & mill process research costs.

IV. Expanding & Polystyrene Plant Impact

With the exception of closing the L.A. plant (assumed in all cases, including the Base Case), no expanding or polystyrene plants were assumed to be closed in Case A.

V. Selling Expenses

Case A selling expense reductions amounted to \$1,070,000 in 1977, including \$900,000 in BPD and \$170,000 in Ag/Hort. These reductions reflect sales headcounts, marketing headcount, and other selling expense reductions (e.g., advertising).

VI. Capital Spending

A. Expanding Plants

The 1977 Capital Budget and Forecast included \$1.0 mm in Capital Spending, sufficient to bring seven expanding plants within a 2.0 f/ml OSHA standard. To meet the 1.0 f/ml standard assumed in this case, an additional \$200,000 capital over the Base Case Capital Spending has been reflected. However, this was offset by Capital Spending reductions of approximately \$600,000 per year over 1977 to 1981 at the expanding plants. These reductions reflect cancellation of the need for most expansion projects (e.g., furnace capacity expansion) and the stretching out of major replacements (e.g., furnace replacements).

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B. Libby

The \$515,000 capital required to meet a 2.0 f/ml standard for MESA had also already been reflected in the Base Case capital. In addition, due to the very low volume levels at Libby, major reductions in projected capital spending plans were assumed. These total \$5,000,000 over the 1977-1980 period and include eliminations of mine garage, haul truck capacity increases, mill process improvements and capacity increases (e.g., #5 unit), office expansion, etc. These reductions also reflect delays in the need for major replacements of mining equipment scheduled over the forecast period.

The impact of these capital spending reductions at the plants and Libby on Net Fixed Assets amount to \$664,000 less than Base Case in 1977 and \$6,270,000 less in 1980.

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VII. Summary of Financial Implications (\$000)

	Variance Fav/(Unfav) vs. Base Case			
	1977	1980	Amount	%
A.) <u>Gross Sales (Impact in 1977)</u>				
BPD (attic \$3,638; Glass \$623; Poly \$544 and Ag Products \$932)	\$ (6,037)	(12.2)%	\$(10,318)	(14.4)%
AG (Terra-Lite \$1,542; Mixer \$705)	(2,563)	(24.6)	(4,638)	(30.6)
Ore (Scott \$300; Canada \$1,835)	(2,784)	(44.5)	(5,578)	(61.2)
TOTAL	\$11,384	(17.2)%	\$(20,534)	(21.4)%
B.) <u>Gross Margin on Net</u>	(4,640)	(17.3)	(8,903)	(22.1)
C.) <u>Factory Overhead (primarily Libby reductions)</u>	622	5.5	2,281	16.8
D.) <u>Operating Expense (BPD/Ag Selling \$1,070 and the remainder at Libby)</u>	1,334	10.1	2,513	13.8
E.) <u>Pre-Tax Profit</u>	(2,684)	67.8	(4,109)	48.3
F.) <u>Taxes</u>				
Before ITC and Depletion	1,359	67.5	2,117	48.5
ITC	(23)	(6.2)	(140)	(49.1)
Depletion After-Tax	82	33.7	(462)	(47.2)
TOTAL TAXES	\$ 1,418	100.0%	\$ 1,515	48.9%
G.) <u>Net Income After-Tax</u>	\$1,266	(49.5)%	(2,594)	(46.0)%
H.) <u>TCE</u>				
Working Capital Due to Lower Sales	1,349		2,767	
Net Fixed Assets	664		5,270	
TOTAL	\$ 2,013	6.5%	\$ 8,037	21.6%
I.) <u>% Return on TCE</u>	(3.8)% Pts.		(4.8)% Pts.	

A more detailed comparison is shown following the case discussions in Exhibit 1-3.

CASE B - Selective Consumer Product Withdrawal; Labelling all other Consumer Products.

I. Overall Case Assumptions,

- A. OSHA to 1.0 f/ml by 12/77 and 0.5 f/ml by 12/80
MESA to 2.0 f/ml by 12/77
- B. Withdraw only Attic, Pool Cushion, Glass Fiber, and Santoquin.
- C. Label all other consumer products; Ag/Bag if on Libby.
- D. Avoid labelling by bringing tremolite in products to lower levels, e.g., treatment, use of South Carolina ore, etc.
- E. Canada stays in Attic business.

II. Market & Product Impacts

A. Withdrawal

Withdraw from Attic business results in simultaneous withdrawal of Glass Fiber and a significant impact on dealer Plainboard sales (same as CASE A).

Withdrawal of Pool Cushion and Santoquin have no impact on other Ag sales.

B. Labelling

Only consumer Products and Ag Bag & Bulk from Libby ore would be labelled. Labelling impact is summarized below:

Ag Bag & Bulk - Same as CASE A.

Terra-lite Consumer - 15% reduction versus Base Case in 1977 and eventually 50% of Base Case volume by 1980. Offset by 30% increase in Hort. Perlite.

Soil Mixes - Consumer - 15% reduction versus Base Case in 1977 and down to 25% off Base Case volume by 1980.

C. Treated Products

To avoid labelling, Masonry Fill, Misc. expanded, and Plaster Aggregate are treated with a water or water/oil solution to achieve fiber standards in finished products. This treatment results in 6.0% yield penalty on coarse Libby ore sizes and 3.0% penalty on Libby sizes 3 & 4.

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D. Ore Sales

Licensees, Independents, Gypsum Co. - As in CASE A.

Canada - Base Case levels.

Scott - South Carolina ore more available than in CASE A (see Ore Section III below), and allows Scott demand to be met totally from South Carolina. However, it is assumed that they will continue to use more South African ore and at best Zonolite retains 22,000 tons (versus 26,000 tons in 1977 Budget) of Scott business through 1981.

III. Impact on Mines & Ore Allocation

Since the treatment of Libby ore for Masonry Fill precludes the CASE A need to shift Masonry Fill to South Carolina ore, the South Carolina mine has capacity available to meet all O. M. Scott ore demand. (Without this move, Scott demand would be only 8,000 tons in 1980 on Libby ore while 1980 demand would be 22,000 tons if supplied with South Carolina ore).

The South Carolina mine demand will thus, continue to be high with it reaching 116,000 tons in 1977 and 132,000 tons (or full capacity) by 1980. DMC and overhead levels are as assumed in CASE A. Also, as in CASE A, the additional volume results in increased tax depletion at Enoree versus the Base Case.

Libby volume is at 177,000 tons in 1977 (versus a Base Case of 229,000 tons) and grows to 208,000 tons in 1980. The 52,000 ton reduction versus the Base Case in 1977 results from volume losses in: Attic Fill 16,000 tons, and Outsiders (excl. Canada) 10,000 tons. The reduction also reflects the shift of 26,000 tons of Scott ore to South Carolina.

At these volume levels, Libby's DMC is estimated to remain at 1977 Budget & Forecast levels. In 1977, Libby's net income would be a loss of \$422,000 but by 1980, Libby would generate a net income of \$500,000 with the volume reaching 208,000 tons. However, the Libby operation would still represent a substantial cut-back. In 1977, the mill would operate a 5-day week for 41 $\frac{1}{4}$ weeks (or a 4-day week for the full year) and still face a 2 $\frac{1}{2}$ month shutdown. Once again, as in CASE A, there has been no attempt to quantify the potentially negative impact of such a cut-back operation on turnover of valuable skilled and management people. By 1979, or 1980, the volume levels would once again be sufficient to represent just about a full-scale operation with only a 3-4 week shutdown required.

Overhead expense levels would be reduced by \$276,000 in 1977 as follows:

Factory Overhead:	- \$187,000	- Reductions in Overhead dept.
R&D	- \$ 89,000	- Mill Process Research cut-backs.

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IV. Expanding & Polystyrene Plant Impact

Same as CASE A.

V. Selling Expenses

Same reduction in 1977 as CASE A, however, due to additional sales growth (Masonry Fill, consumer Ag/Hort) selling expenses have been assumed to increase commensurably with sales.

VI. Capital Spending

A. Expanding Plants

To meet a 1.0 f/ml standard by 1978 and a 0.5 by 1980, a total of \$1.2 million over the \$1.0 mm included in the Base Case has been reflected in capital spending. However, this \$1.2 million is offset by an average of \$300,000 per year in decreased capital spending at expanding plants over the four-year period due to delays in capacity expansion projects and replacement furnace delays resulting from the lower sales volumes.

B. Libby

The \$515,000 capital required to meet a 2.0 f/ml standard for MESA has already been reflected in the Base Case capital. However, the reduced volumes at Libby would enable significant capital spending decreases over the 1977-1981 period. These reductions are estimated to be \$1,500,000 over the four-year period and represent the haul truck capacity increases, No. 5 circuit, mill office expansion and delays in the need to replace mining equipment.

The impact of these capital spending reductions on Net Fixed Assets amount to \$180,000 in 1977 and \$1,200,000 in 1980.

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VII. Summary of Financial Implications (\$000)

	Variance Fav/(Unfav) vs Base Case			
	1977	%	1980	%
	<u>Amount</u>	<u>%</u>	<u>Amount</u>	<u>%</u>
A.) <u>Gross Sales</u> (Impact in 1977)				
BPD (Attic \$3,638, Glass Fiber \$623; Poly \$544; and Ag Products \$370)	\$ (5,175)	(10.4)%	\$ (9,365)	(13.0)%
Ag (Pool Cushion \$270, Mixes \$129, T.L. - \$93, Ag Bag/Bulk \$108)	(751)	(7.2)	(1,760)	(11.6)
Ore	(563)	(9.0)	(1,355)	(14.9)
TOTAL	\$ (6,489)	(9.8)%	\$ (12,480)	(13.0)%
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
B.) <u>Gross Margin on Net</u>	\$ (2,466)	(9.2)%	\$ (4,681)	(11.6)%
C.) Factory Overhead (primarily Libby)	187	2.0	503	3.7
D.) Operating Expense	<u>1,129</u>	<u>8.5</u>	<u>1,731</u>	<u>9.5</u>
E.) Pre-Tax Profit	\$ (1,150)	(29.1)%	\$ (2,447)	(28.7)%
F.) <u>Taxes</u>				
Before ITC & Depletion	569	28.3	1,261	28.9
ITC	(30)	(8.1)	(30)	(10.5)
Depletion After-Tax	<u>73</u>	<u>30.0</u>	<u>(399)</u>	<u>(40.8)</u>
TOTAL TAXES	\$ 612	43.7%	\$ 832	26.8%
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
G.) Net Income After-Tax	\$ (538)	(21.0)%	\$ (1,615)	(30.1)%
H.) <u>TCE</u>				
Net Working Capital due to Lower Sales	\$ 774		\$ 1,687	
Net Fixed Assets	<u>180</u>		<u>1,200</u>	
TOTAL	\$ 954	3.1%	\$ 2,887	7.8%
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>
I.) % Return on TCE	(1.5)% Pts.		(3.4)% Pts.	
<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>

A more detailed comparison is shown following the Case discussions in Exhibits 1-3.

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CASE C - Withdrawal of Consumer Products and Most Unfavorable Outside Regulatory Action.

I. Overall Case Assumptions

- A. Fiber Counts to 0.1 f/ml (OSHA) by 12/80 and MESA to 1.0 f/ml by 12/80.
- B. Withdraw consumer products, and temporarily lose MK before substitution by 7/78 in California.
- C. Lose Canada
- D. Close Libby and reformulate to husband ore or go to regional "Zonolite as is" strategy around Enoree orh only.

After withdrawal of consumer products, the loss of Canada, and high capital impact needed to meet more stringent OSHA and MESA standards (\$10 million) resulting in closings of many expanding plants, the resultant low volumes of Libby ore would no longer make continued operation there feasible. Therefore, by 1980, CASE C resulted in an Enoree only situation. This situation was analyzed under (1) a national strategy and (2) a regional strategy and is presented in the following pages.

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CASE C - National StrategyI. General Scenario

Zonolite would be limited to vermiculite ore shipped from Enoree and would be capacitated at 130,000 tons. Thus the scarce resources were utilized on products and plants contributing the most favorable Zonolite margin per ton of concentrate. In addition, it was assumed that certain products would be reformulated with vermiculite substituted or extended (e.g., high yield ZIC) to stretch the limited ore capacity.

II. Market & Product ImpactsA. Reformulation

Concrete Aggregate - Reformulated to contain a high yield ZIC. This reformulation would cover the 1980 Base Case Sales volume with 50% of the ore required. Sales price and margin (except impact of ore freight and cost from Enoree) were left unchanged from Base Case. This may be a somewhat conservative assumption since it implies that a high yield additive would replace vermiculite and cost as much as \$0.70 per 4 cu.ft. bag in 1980 dollars.

MONOKOTE - MONOKOTE is dramatically impacted in this case due to the withdrawal from California and the subsequent ripple effect of this into the other regions. In California, MONOKOTE volume would fall by 83% in 1978 but then double by 1980 so that the non-vermiculite product amounted to only 31% of 1980 Base Case volume in California. The Texas, Midwest, Southern, and Florida regions would all be impacted by the California withdrawal in 1978 by about a 30% reduction from Base Case. Growth from there to 1980 would only be about 5% with a substitute product so that in these regions, 1980 volume would be 2/3 of 1980 Base Case. Eastern Region volume impact would be off by 43% from Base Case volumes in 1980. In all Regions, the substitute product was assumed to retain the same price and margins as a vermiculite product.

Soil Mixes - All consumer soil mixes and Professional soil mixes would be reformulated without vermiculite and result in a 10% volume loss versus Base Case in 1980 as a result of the reformulation. Prices and margins would be the same as Base Case. This also may be conservative since it implies that a bark ash substitute for example, would be just as costly as vermiculite. However, there would be long-term supply questions associated with bark ash.

B. Withdrawal

Attic, (and its impact in Poly sales), Terra-lite Consumer, Pool Cushion, Santoquin would all be withdrawn.

C. Mine Capacity Constraint Impact on Demand

Masonry Fill demand would still be met nationally from plants remaining open (see Section IV). However, ore capacity constraints necessitated using price as a mechanism to reduce demand and thus, the overall gross sales impact on Masonry Fill. (Masonry Fill was chosen due to its price sensitivity and relatively low margin contribution per ton of concentrate). Overall, Masonry Fill sales are off \$1,270,000 (14.4%) versus 1980 Base Case, resulting from 4% higher prices (\$0.10 per bag) and overall volume being down by 18%. This volume decline was 30% at areas where plants were closed and 6% at open plants due to the higher prices.

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Ag Bag & Bulk demand would be met at Base Case volumes with the exception of the Pacific and Texas Regions where it would be discontinued.

D. Outside Ore Sales

No outside ore sales would be continued. The Enoree mine capacity would be applied totally to internal product usage. In addition, the Canadian business is assumed closed in this case.

III. Impact on Mines

All Zonolite vermiculite needs would be supplied from Enoree. Enoree's DMC per ton, Overhead, and Capital Spending levels were all kept at Base Case for 1980. However, the ore freight impact and favorable DMC of S.C. vs. Libby were reflected in the Zonolite margins.

S. C. volume was assumed to be capacitated in 1980 at 130,000 tons. A subset of CASE C (national strategy) would have been to identify the capital cost and benefits of a S.C. mill expansion, but this was not investigated in this study.

Total 1980 Base Case mine volume shipped to expanding plants would have been 242,000 tons. This amount was reduced to 130,000 tons as follows:

Total 1980 Base Case mine Shipments to Expanding Plants	242,000 tons
Withdrawal of Attic	(19,900)
" of Consumer T.L. and mixes & Other Ag.	(7,300)
Impact of High Yield ZIC	(40,300)
Substitution for MK & Soil Mixes	(36,600)
Ag Bag & Bulk from Texas & Pacific	(6,700)
Masonry Fill Lost to Closed Plants	(7,000)
Yield Impact	5,800
	130,000

IV. Expanding & Polystyrene Plant Impact

The following plants were assumed closed based on their relative margin contribution, overhead levels, and the estimated capital requirement to comply with a 0.1 f/ml OSHA restriction by 1980.

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<u>Capital Required to get to 0.1 f/ml</u>	
Tampa	\$ 83.0
Dearborn	440.0
Muirkirk	232.0
Minneapolis	220.0
Denver	208.0
Omaha	459.0
L. A.	328.0
Newark	293.0
San Antonio	275.0
	<hr/>
	\$2,538.0

Demand at the closed plants was assumed to be met from the nearest operating plant for vermiculite and non-vermiculite substitute products. This inter-plant transfer freight penalty amounts to \$800,000 in 1980, or, \$0.44/bag (ranging from \$.20/bag to serve Tampa to \$0.83/bag to serve Denver) on a total of 1.8 million bags. This number is reflected in sales deductions and accounts for the higher level (5.5% vs 4.1% in other cases) of deductions as a % of Net Sales.

Also note that due to the minimal impact on Poly sales (only the dealer effect on Plainboard, approximately 9% of total Poly Sales) no poly plants were assumed to be closed.

V. Operating Expenses

Selling Expenses

The same cut-back in selling expenses as used in CASE A was used to reflect the withdrawal from consumer products. Although CASE C (national strategy) is \$11,025,000 lower in sales versus CASE A, no additional selling expense reductions were assumed since: a) \$3.7 million of the reduction is due to Outside Ore Sales and Ag Bag & Bulk which have no directly identifiable selling expense, b) \$7.6 million of the loss is due to MONOKOTE and the Base Case selling expense levels have been assumed to reflect the attempt to recapture market position lost due to the California MK withdrawal and substitution.

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G&A

G&A reductions versus Base Case reflects the elimination of Libby in 1980 (\$1,256,000) and an additional unidentified \$300,000 reduction due to reduced number of plants and sales.

R&D

R&D reductions versus Base Case reflect the elimination of Libby in 1980 (\$243,000). Although sales are less and major R&D effort to find vermiculite substitutes occurred before 1980, other R&D expense is left at Base Case levels to reflect: a) ongoing new product development, b) continued R&D expense to monitor substitutions, and c) the fact that most sales decreases are not in areas where heavy R&D expenditures have occurred.

VI. Capital Spending

Libby Capital Spending, of course, has been eliminated due to its closing. Enoree & Poly plant capital spending levels were left at Base Case amounts. The major capital spending impact versus the Base Case occur at the expanding plants.

	Fav/(Unfav)	1980 Net Book
	Total Spending vs.	Value Impact
	Base Case over 1977-1980	(\$000)
Capital to achieve 0.1 f/ml at Retained Expanding Plants	\$ (4,636)	\$ (3,969)
Eliminated Capital Spending at Closed Plants	2,100	1,858
Delays beyond 1980 in Exp. Plant Expansion	700	530
Net Book Value of Closed Plants	-	350
Total Exp. Plants	\$ (1,836)	\$ (1,231)
Libby Capital Spending	6,856	10,805
Total Zonolite	\$ 5,020	\$ 9,574

In addition to the above, closing Tampa and eliminating the national ore hopper car fleet servicing Libby, capitalized leases totalling \$933,000 (after-tax cost of interest \$39,000) would be discontinued.

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VII. Summary of Financial Implications (\$000)

		<u>Variance Fav/(Unfav) vs: Base Case</u>
	<u>1980</u>	<u>%</u>
A.) <u>Gross Sales</u> (Impact in 1980)	<u>Amount</u>	
BPD (Attic \$5,280; MK \$7,607; Poly \$1,366; Glass Fiber \$1,985; MF \$1,270, Ag Prod- \$1,658)	\$(19,166)	(26.7)%
Ag (Consumer \$3,221)	(2,380)	(15.7)
Ore Sales	<u>(9,119)</u>	(100.0)
TOTAL	\$(30,665)	(31.9)%
B.) Deductions		
Due to volume	\$ 802	20.6%
Transfer Freight	<u>(800)</u>	-
	\$.2	-.%
C.) <u>Gross Margin on Net</u>	\$(14,484)	(36.0)%
D.) Factory Overhead (Libby \$4,590; closed plants (\$1,149)	6,139	45.2
E.) Operating Expenses (BPD/Ag Selling \$1,900; Libby G&A \$1,256,000; Div. OH \$300)	3,699	20.4
F.) Other Expense	<u>39</u>	100.0
G.) Pre-Tax Profit	<u>\$(4,607)</u>	(54.1)%
H.) Taxes		
Before ITC & Depletion	2,373	54.4
ITC	<u>(112)</u>	(39.3)
Depletion	<u>(477)</u>	(48.7)
TOTAL TAXES	1,784	57.5
I.) Net Income After-Tax	\$ (2,823)	(52.5)%
J.) TCE		
Working Capital Due to Lower Sales	\$ 4,181	
Net Fixed Assets (Section VI)	10,507	
Deferred Taxes	<u>(1,087)</u>	
Other Assets	<u>82</u>	
	<u>\$ 13,683</u>	<u>36.8%</u>
K.) % Return on TCE		
	(3.6)%	15101954

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CASE C - Regional Strategy

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I. General Scenario

Zonolite would be limited to vermiculite ore shipped from Enoree and would be capacitated at 130,000 tons. The limited vermiculite resource was utilized by applying it to existing vermiculite products (no re-formulations or extenders) and utilizing the highest contribution plants and minimizing the capital expenditures required to meet a 0.1 f/ml OSHA standard. The net effect was to localize the Zonolite business to the most profitable expanding plants located closest to the Enoree ore source. Therefore, the regional strategy included the entire Southern and Florida regions and the larger plants extending into the East and Midwest Regions. NO Inventory Transfers were assumed. If a plant was closed, then no attempt was made to ship into the vacated market from nearby plants with the exception of Professional soil mixes, which continued to serve the areas now met from TR, West Chicago, and Jacksonville.

II. Market & Product ImpactsA. Consumer Product Withdrawal

Attic (and its impact on Poly & Glass Fiber), Terra-lite consumer, Consumer soil mixes, Pool Cushion, and Santoquin would all be withdrawn. Unlike Case C (National Strategy), consumer soil mixes were not reformulated. Horticultural Perlite to Consumer market increase vs. Base Case by 30% in 1980 to offset loss of vermiculite business.

B. Impact of Plant Closing on Sales

BPD - Base Case volume and prices were used at all plants remaining open. Demand from closed plants was not filled. Therefore, remaining BPD sales amounted to Base Case levels in the Southern & Florida Regions plus the portion in Midwest and Eastern Regions retained with the remaining plants. Total sales in Texas and Pacific were taken out and all Attic and Glass Fiber sales for BPD, of course, were withdrawn in all regions. The impact of plant closings by product are as follows:

BPD Vermiculite (ex. Attic)	1980 (\$000)		% Variance due to plant closings Fav/(Unfav)
	Base Case	Case C (Reg)	
Concrete Aggregate	\$13,739	\$8,477	(38.3)%
Masonry Fill	8,790	5,109	(41.9)
MONOKOTE (No re-formulation)	16,233	6,820	(42.0)
Misc. Exp.	2,410	1,023	(57.6)
Dealer Conc.	553	279	(49.5)
Plaster Agg.	342	174	(49.1)
Mine Sealant (all met from New Castle)	1,589	1,589	-
Other BPD vermiculite	83	-	-
Ag Products (Texas & Pacific Region Plants closed)	2,894	-	(100.0)
BPD Vermiculite	<u>\$46,633</u>	<u>\$23,554</u>	<u>(49.5)%</u>

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BPD Poly

Insulperm sales were retained in the Southern and Florida Regions and reduced in relation to Concrete Aggregate losses in the East and Midwest. No sales in Pacific and Texas. 1980 Reduction of \$1,323,000 or 30.2%.

Billets & Other Poly sales were retained in the Southern and Florida Regions and reduced in relation to plant closings in other regions. No sales in Pacific and Texas.

Plainboard sales were reduced due to impact of Attic withdrawal and plant closings in East and Midwest. Sales retained in total in Florida and Southern Regions. Total sales eliminated in Texas and Pacific Regions. 1980 Reduction - \$2,590,000 or 33.2%.

Custom molded - All Pacific Region sales eliminated in amount of \$750,000.

Ag/Hort

Terra-Lite - Consumer Products withdrawn in total. Professional Terra-lite retained in South and Florida and reduced in relation to plant closings in East and Midwest. 1980 Reduction - \$1,785,000 or 45.1%. \$1,130,000 of total reduction was due to elimination of consumer products, \$655,000 of reduction due to plant closings or 23.2% of Base Case Professional sales.

Soil Mixes - Consumer soil mixes withdrawn in total without substitution and resulted in the only reduction in Soil Mixes of \$1,454,000. Professional soil mixes were retained without reformulation at Base Case volumes and would continue to be made from West Chicago, Jacksonville, IR, and New Castle (mixing capacity expansion done in 1979). Therefore, Professional mixes would continue to be sold in all areas as in Base Case even though some areas would no longer have expanding plants and would require a greater degree of direct shipments to customers. Because of this increase in freight cost to customers, no increase in Professional soil mix demand over the Base Case due to decrease in Professional Terra-Lite has been reflected as was done in CASE A.

CPBA & Ag Bag & Bulk were reduced as a result of plant closings. These impacts are reduction of \$576,000 (27.8%) in Ag Bag & Bulk and \$171,000 (21.4%) in CPBA versus the Base Case.

III. Impact on Mines

All Zonolite vermiculite needs would be supplied from Enoree. Enoree DMC per ton, overhead, and Capital Spending levels were all kept at Base Case for 1980. However, the ore freight impact and favorable DMC of S.C. vs. Libby, were reflected in the Zonolite margins.

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S.C. volume was assumed to be capacitated in 1980 at 130,000 tons. A sub-set of CASE C (regional strategy) would have been to identify the capital cost and benefits of a S.C. mill expansion, but this was not investigated in this study.

Total 1980 Base Case mine volume shipped to expanding plants would have been 242,000 tons. This amount was reduced to 130,000 tons as follows:

Total 1980 Base Case Mine Shipments to Expanding Plants	242,000 tons
Withdrawal of Attic	(19,900)
" of Consumer T.L. and mixes & Other Ag.	(7,300)
" from Pacific Region	(38,800)
" from Texas Region	(13,800)
Plant Closings in Eastern & Midwest Region	(32,200)
	<u>130,000</u>

IV. Expanding & Polystyrene Plant Impact

The following 19 plants were assumed closed under a regional Zonolite strategy:

	Capital Required to meet 0.1 f/ml (\$000)
Dearborn	\$440.0
Weedsport	125.0
Easthampton	232.0
Muirkirk	232.0
Minneapolis	220.0
Denver	208.0
Omaha	459.0
Milwaukee	158.0
L. A.	328.0
Newark	293.0
Portland	315.0
Phoenix	313.0
Santa Ana	213.0
Oklahoma City	123.0
San Antonio	275.0
Dallas	417.0
Houston Poly	-
Auburn Poly	-
South Gate Poly	-
	<u>\$4,351.0</u>

Elimination of the above plants leaves all expanding & Poly plants in the Southern and Florida Regions along with Trenton, High Point, and New Castle from the East and St. Louis, Wilder, and West Chicago in the Midwest. Also remaining would be the New Castle and Milwaukee Poly plants. The plants remaining total 18 (14 vermiculite and 4 Polystyrene).

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V. Operating ExpensesSelling Expenses

Selling expenses reflect regional selling expenses at CASE C sales levels (10.5% of BPD net sales and 13.0% of Ag/Hort and 11.9% overall). In addition, divisional selling expenses totalling \$1.3 million (versus Base Case of \$2.4 million) have been added to reflect continuing divisional marketing and sales management under the modified regional strategy. This number was not calculated as a percentage of sales but was derived based on input from BPD sales and marketing management.

G&A

G&A expense includes Enoree at Base Case levels (\$425,000) and \$1,802,000 reflecting 4.2% of net sales, consistent with Zonolite's Base Case G&A expenses as a percentage of net sales (excluding Libby expenses of \$1,256,000).

R&D

R&D expenses include Enoree and LOU at Base Case levels (\$302,000) and \$472,000 reflecting 1.1% of Case C net sales, a percentage relationship consistent with Base Case R&D levels relative to BPD and Ag net sales.

VI. Capital Spending

Capital Spending at Libby, closed expanding and poly plant, and delayed expansion projects at remaining plants were all taken away versus Base Case capital levels. The offset to these decreases includes capital spending to meet a 0.1 f/ml OSHA standard at remaining plants. Capital Spending and Net Book Value Impact vs. the Base Case follows:

	Fav/(Unfav)	1980 Net Book Value Impact
	Total Spending vs: Base Case over 1977-1980	
Capital to Achieve 0.1 f/ml at Retained Expanding Plants	\$ (3,244)	\$ (2,617)
Eliminated Capital Spending at Closed Plants	4,481	3,254
Delays beyond 1980 in Expansion Projects	434	202
Net Book Value of Closed Plants	-	1,512
Libby Capital Spending	6,856	10,805
Total Zonolite	<u>\$8,527</u>	<u>\$13,156</u>

In addition, closing Libby allows elimination of capitalized leases on national ore hopper car fleet and total value of \$683,000 (\$28,000 after-tax cost of interest).

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VII. Summary of Financial Implications (\$000)

	<u>Variance Fav/(Unfav) vs: Base Case</u>	
	<u>1980</u>	<u>%</u>
A.) <u>Gross Sales (Impact in 1980)</u>	<u>Amount</u>	
BPD (Consumer withdrawals - \$7,870; Plant Closings - \$29,480)	\$ (37,350)	(52.0)%
Ag (Consumer - \$3,321; closings \$1,214) Ore	(4,535) <u>(9,119)</u> <u>\$ (51,004)</u>	(29.9) (100.0) (53.0)%
B.) <u>Gross Margin on Net</u>	<u>(21,386)</u>	<u>(53.1)</u>
C.) <u>Factory Overhead (Libby \$4,590 and Plants - \$2,651)</u>	<u>7,841</u>	<u>57.7</u>
D.) <u>Operating Expenses (Selling - \$5,426; G&A 3,004 & R&D \$671)</u>	<u>9,101</u>	<u>50.1</u>
E.) <u>Other Expense</u>	<u>39</u>	<u>100.0</u>
F.) <u>Pre-Tax Profit</u>	<u>(4,405)</u>	<u>(51.8)%</u>
G.) <u>Taxes</u>		
Before ITC & Depletion	\$ 2,269	52.0%
ITC	(183)	(64.2)
Depletion	(477)	(48.7)
	<u>\$ 1,609</u>	<u>51.9%</u>
H.) <u>Net Income After Tax</u>	<u>\$ (2,796)</u>	<u>(52.0)%</u>
I.) <u>TCE</u>		
Working Capital Due to Lower Sales	\$ 6,912	
Net Fixed Assets (Section VI)	13,839	
Deferred Taxes	(800)	
Other Assets	82	
Total	<u>\$20,033</u>	<u>53.8%</u>
J.) <u>% Return on TCE</u>	<u>0.6 Pts.</u>	

A more detailed comparison is shown following the Case discussion in Exhibits 1-3.

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SCHEDULE I
SUMMARY OF CASE ASSUMPTIONS ON PRODUCTS

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	<u>CASE A</u>	<u>CASE B</u>	<u>CASE C</u> Regional	<u>CASE C</u> National
Attic Insulation	Withdraw			
Concrete Aggregate	No Impact	→		High Yield Conc.
Masonry Fill	Label Libby	Treat Libby		Plant Closings
MONOKOTE	No Impact	→	Sales Losses due to Plant Closings	Mkt. Losses & Reformulations.
Misc. Expanded	Label Libby	Treat Libby		No Impact
Dealer Concrete	No Impact	→		No Impact
Plaster Aggregate	Label Libby	Treat Libby		No Impact
Terra-Lite - BPD	Drop Cons.	Label Consumer		Drop Consumer.
Soil Mixes - BPD	Drop Cons.	Label Consumer		Drop Consumer
Pool Cushion	Withdraw			
Ag Bag/Bulk - BPD	Label Libby	Label Libby	Plant Closings	Plant Closings
Mine Sealant	No Impact	→		
Other BPD Vermiculite	No Impact	→		
Insulperm	No Impact	→	Parallels Concrete	No Impact
Plainboard	Impact of Attic Loss			
Billets	No Impact	→	Sales Losses	No Impact
Custom	No Impact	→	due to Plant Closings	No Impact
Other Poly	No Impact	→		No Impact
Nails	No Impact	→	Parallels Concrete	No Impact
All Other BPD	Drop Glass			
Terra-lite	Drop Consumer; Label Prof.	Label Consumer	Drop Consumer	Drop Consumer.
Soil Mixes	Drop Consumer; Inc. Prof.	Label Consumer	Drop Consumer	Drop Consumer & Reformula
CPBA	Label	Label	Plant Closings	Label
Pool Cushion	Withdraw			
Ag Bag & Bulk	Label Libby	Label Libby	Plant Closings	
Verxite	No Impact	→		
Santoquin	Withdraw			
Other as Verm.	Drop Cons.	No Impact	Drop Cons.	
Perlite (Hort.)	Increase	Inc. Cons.	Inc. Consumer	No Impact
Ore to O.M. Scott	Decrease	Decrease	Discontinued	→
" " Gypsum Cos.	Decrease	Decrease	Discontinued	→
" " Canada	Discontinued	Inc. G. S.	Discontinued	→
" " Other Outsiders	Decrease	Decrease	Discontinued	→

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Schedule 2

GROSS SALES COMPARISON

(\$000)

	1977		1980		CASE C	
	BASE CASE	CASE A	BASE CASE	CASE A	CASE B	NAT. STRAT. REG. STRAT.
Attic Ins.	\$1,638	\$	\$15,280	\$	\$	\$
Concrete Agg.	8,962	8,962	11,739	13,736	13,739	8,477
Masonry Fill	6,374	6,318	8,790	8,700	7,520	5,109
Manokote	11,092	11,092	16,233	16,233	8,626	6,820
Misc. Eng.	2,004	1,818	2,004	2,410	2,410	1,023
Dealer Conc.	476	476	553	553	553	279
Plaster Ag.	272	211	272	199	342	174
Terralite	513	189	508	632	540	-
Soil Mines	934	660	900	1,110	775	1,060
Pool Cushion	33	-	-	40	-	-
Ag Bag/Bulk	916	655	655	1,112	560	-
Mine Sealant	500	500	500	1,589	1,589	1,589
Other BPO Vermiculite	63	63	63	83	83	83
Sub-Total BPO Vermiculite	35,817	31,944	31,806	51,913	44,946	45,899
Insulperm	2,554	554	554	4,379	4,379	4,379
Plainboard	5,802	5,258	5,258	7,810	6,444	6,444
Bullets	480	480	480	692	692	692
Custom	507	507	507	750	750	750
Other Poly	943	943	943	1,414	1,414	1,414
Sub-Total BPO Poly	10,286	9,742	9,742	15,045	13,679	13,679
Nails	1,198	1,198	1,198	1,793	1,793	1,793
All Other BPO	2,330	1,710	1,710	3,145	1,160	1,160
Total BPO	49,561	43,594	44,456	71,696	61,528	62,531
Terralite	2,427	885	2,334	3,954	890	3,391
Soil Mines	4,023	3,318	3,899	5,127	4,200	4,275
CPBA	531	425	425	800	660	659
Pool Cushion	270	-	-	355	-	-
Ag. Bag & Bulk	1,485	1,339	1,339	1,933	1,484	1,484
Verxite	222	222	222	284	284	284
Santquin	50	-	-	72	-	-
Other Ag. Verm.	57	40	57	380	70	70
Sub-Total Ag. Verm.	9,064	8,229	8,276	12,905	7,588	10,968
Perlite	1,361	1,633	1,398	2,253	2,932	2,430
All Other Ag.	-	-	-	-	-	-
Total Ag.	10,425	7,862	9,674	15,158	10,520	13,398
Ore to O. M. Scott	1,171	874	1,061	1,708	297	1,246
Ore to Gypsum Cos.	1,193	1,133	1,133	1,698	1,330	1,330
Ore to Canada	1,835	1,469	966	2,892	3,047	3,047
Ore to other outsiders	2,061	3,476	5,697	2,821	1,914	2,141
Total Ore	6,250	5,476	5,697	9,119	3,541	3,761
Total Zonolite	366,316	354,935	359,827	366,173	375,639	383,693
						345,769

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PROFITABILITY & RETURN ON ICE COMPARISON

ZOMOLITE

(\$000)

Schedule 3

03629722

	1977			1980		
	BASE CASE	CASE A	CASE B	BASE CASE	CASE A	CASE B
Gross Sales	\$54,932	\$59,827	\$59,827	\$96,173	\$75,639	\$81,693
Sales Deductions	2,231	2,231	2,231	3,992	3,125	3,461
Net Sales	<u>52,700</u>	<u>57,303</u>	<u>57,303</u>	<u>92,181</u>	<u>72,517</u>	<u>80,737</u>
Direct Mfg. Cost	36,646	30,493	32,920	52,012	41,148	44,644
Gross Margin	26,849	22,207	24,383	40,269	31,366	35,583
G. M. on Gross %	44.7%	44.5%	45.0%	45.8%	45.6%	46.7%
G. M. on Net %	42.3%	42.1%	42.6%	43.6%	43.3%	44.4%
Factory O.H.	9,397	8,771	9,210	13,581	11,300	13,078
Gross Profit	<u>17,452</u>	<u>13,431</u>	<u>15,173</u>	<u>26,688</u>	<u>22,510</u>	<u>18,343</u>
Selling	8,419	7,341	7,379	11,500	9,600	10,100
G & A	4,101	3,956	4,101	5,231	4,724	5,000
R & D	73,749	6,311	6,660	1,445	1,339	1,345
Operating Expense	<u>73,269</u>	<u>11,931</u>	<u>12,140</u>	<u>18,176</u>	<u>15,663</u>	<u>16,443</u>
Operating Profit	<u>4,183</u>	<u>1,491</u>	<u>3,033</u>	<u>8,512</u>	<u>4,403</u>	<u>6,065</u>
Other Inc./Exp.	(227)	(221)	(227)	(39)	(39)	(39)
Pre-Tax Profit	<u>3,956</u>	<u>1,272</u>	<u>2,806</u>	<u>8,473</u>	<u>4,364</u>	<u>6,016</u>
Taxes on Income (Before ITC & Depletion)	2,014	655	1,445	4,164	2,247	3,133
ITC	271	348	341	285	145	255
Depletion Credits	243	325	316	979	517	580
Total Taxes	<u>1,200</u>	<u>116</u>	<u>768</u>	<u>3,100</u>	<u>1,585</u>	<u>2,268</u>
Profit After Tax	\$ 2,556	\$ 1,290	\$ 2,018	\$ 5,373	\$ 2,779	\$ 3,758
Total Capital Employed	\$30,891	\$28,872	\$29,937	\$37,215	\$29,178	\$34,128
Return on ICE	8.5%	4.7%	7.0%	14.6%	9.8%	11.2%

1 Return on ICE

5101963

APPENDIX IV

**RESPIRABLE TROMOLITE FIBER EXPOSURES FOR
ZONOLITE FINISHED PRODUCTS IN INTENDED USES**

Product	Grade of Ore Used	8 Hour TWA Exposure (f/min)		Maximum 15 Minute Exposure (f/min)	Using S.C. Ore Using Libby Ore (f/min)	Using S.C. Ore Using Libby Ore (f/min)
		Using S.C. Ore (f/min)	Using Libby Ore (f/min)			
<u>STANDARDS</u>						
Present OSHA		2.0	2.0	10.0	10.0	
Proposed OSHA		0.5	0.5	5.0	5.0	
Proposed NIOSH		0.1	0.1	0.5	0.5	
<u>PURE VERMICULITE</u>						
ATTIC INSULATION	#1	-	0.58 (N/A)	-	-	4.28
	#2	-	1.32	-	-	N/A
MASONRY INSULATION	#3	0.03	0.07	0.21	0.61	3.11
	#4	1.02	0.19 C-13	0.65	3.65	
ZINC - CHARGER MAN	#3	-	0.55	-	9.12	
	#4	0.02	0.45	0.14	1.14	
	#4.5	0.02	-	0.11	1.66	

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ESW/CCR
5-12-77

Fairleigh Dickinson University

RUTHERFORD TEANECK MADISON

APPENDIX V

31 March 1977

Dr. Heyman C. Duecker
Vice President-Research
Construction Products Division
W.R. Grace & Company
62 Whittemore Avenue
Cambridge, Mass. 02140

FLORHAM-MADISON CAMPUS
285 Madison Avenue
Madison, New Jersey
Area Code 201
372-4700

03629724

Dear Dr. Duecker:

This responds to your letter of the 18th in which you ask for comment on a NIOSH report of December 1976 that recommends a revision of the asbestos standard to 0.1 fiber > 5 μ per cc.

As I read this document, it does not present evidence for hazard from either a 5 fiber or 2 fiber per cc standard. Essentially, it argues that risks from low level exposures to asbestos are indicated by reports of mesotheliomas associated with brief or with non-occupational exposures, such as "household" exposures of persons living in the houses of asbestos workers, but levels of such exposures are not stated. That "household" exposures have been substantial was indicated by Dr. Selikoff at a Conference on Environmental Cancer that I attended in Washington last week.

The NIOSH report mentions mesotheliomas in individuals with history of asbestos exposure for only one day. Such cases could, of course, be unrelated to asbestos, as indicated in the NIOSH statement (Page III-7) that approximately 15 per cent of mesotheliomas are not known to be related to exposure to asbestos.

An earlier NIOSH report (Gillam et al) has been cited as showing tumor response to low levels of asbestos. In referring to this, the 1976 NIOSH report (III-10) states: "In a study of a group of miners exposed to amphibole fibers in the cummingtonite-grunerite ore series, Gillam et al (1976) have demonstrated mortality from malignant respiratory disease three times that of the general population."

Referring to the same study, a 1975 OSHA report said: "Gillam et al (1975), studying the mortality and reviewing the chest x-rays of 439 underground metal miners exposed to an asbestos mineral, found three times the risk of malignant respiratory disease than expected. The fiber concentrations averaged 0.24 fibers/ml." (Federal Register, Oct. 9, 1975 pages 47652-47665. Refer to page 47656).

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The claim by Gillam et al for an increased incidence of cancer in the cited miners has not been born out by a more extensive study by McDonald et al (copy attached).

You no doubt have a copy of the above cited 1975 OSHA document. On an enclosed copy of it, I have marked paragraphs that attempt to quantitate exposures to asbestos in relation to occurrence of asbestosis and/or cancer. It should be noted that the level of exposure in the cited British factory in the period 1933-1968 was an estimated level and that no evidence is offered that a 2 fiber level had actually been achieved in the period after 1968.

The 1976 NIOSH report (II-7, II-Table 6) cites a study by Wagner on inhalation exposures of rats to various preparations of asbestos and notes that tumors were found after exposures of only one day. A copy of Wagner's paper is attached. It states that the one-day exposure was 7 hours exposure to dusts containing 9.7 to 14.7 mg per cubic meter of the tested preparations of asbestos.

In March 1976, NIEHS held a 3-day Conference on Extrapolation of Data from Animals to Man. A report on that conference by its chairman is enclosed. I attended that conference and enclose copies of 3 papers that seem of particular pertinence.

The first is a paper by Rall (Director, NIEHS) which addresses the question of threshold levels for carcinogens.

The second is a paper by Enterline and Henderson "A Model for Extrapolating to Low Levels of Asbestos Exposure."

The third is by Hardin Jones. He brings out the point that thresholds for carcinogens should be viewed not only in terms of yield of tumors but also latent period, i.e. that safe levels can be achieved by considering exposures with latent periods longer than the life span.

I understand that CONSAD Research Corp., contractor for inflationary impact study on proposed revision to asbestos standard, is also looking at technical feasibility and economic implications of a 0.1 fiber per cc limit.

Trusting that these remarks may be of interest,

Very sincerely,

William E. Smith
William E. Smith, M.D.
Director
Health Research Institute

WES/clc

Enclosures

See addendum (page 3)

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Addendum

03629726

The enclosed papers from the NIEHS Conference on Extrapolation of Data from Animals to Man are offered merely to provide detail on some current thinking on that subject.

Perhaps a "bottom-line" attitude that seems to be developing in the regulatory agencies was expressed last week by Eula Bingham at the conference I covered in Washington. Dr. Bingham, the new Asst. Secretary of Labor for Occupational Safety and Health, said, according to my notes, "We are ignorant as to whether there is a safe level for carcinogens. The lowest feasible level seems to be the prudent path."

On this theme, the NIOSH document that you sent me contains a statement on page VI-2 that the asbestos standard "should be set at the lowest level detectable by available analytical techniques, an approach consistent with NIOSH's most recent recommendations for other carcinogens."

This approach, or enactment of "zero" levels for carcinogens, would, of course, mean that investment of time and money to achieve any particular level would be precarious; since improvements in sensitivity of analytical techniques could unpredictably change the picture.

Enclosed is an announcement of a seminar in Washington on 12-13 April on Federal Regulation of Environmental Carcinogens. The list of speakers may suggest someone that you could contact for comment or advice. Paul Kotin from Johns-Manville is scheduled to give the lead-off address.

Would it be agreeable for me to send a copy of this letter to Dr. Allan Harvey at R.T. Vanderbilt Co. ?

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TERRITORIAL LEVELS IN BUILDING PROVINCES (EN) 115

Sample 1 is a selected subset of probabilistic samples on of 100.

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TABLE II - TERRILITE LEVELS IN AGRICULTURAL PRODUCTS FND US:5

Product (Ore)	Product Assay-2	SOUTH			ALASKA			LIBBY			Consumer Fiber Count		
		Prof. Fiber Count		Consumer Fiber Count	Prof. Fiber Count		Date - Location	Prof. Fiber Count		Date - Location	Prof. Fiber Count		Date - Location
		Date - Location	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
Hort. Verm.	-	-	-	-	-	-	3/11/77	-	3/11/77	-	-	-	-
Hort. Verm.	4.32, 0.016*	<0.16	0.16	0.070	<0.1*	<0.29	3/11/77 & 3/18/77-Cambridge	0.015*	0.015	0.015	<0.14	<0.14	<0.035
Redi-Search	0.048*	<0.04	0.07	0.018	<0.1*	0.29	3/11/77 & 3/18/77-Cambr.	TO BE SCHEDULED	-	-	-	-	-
Hectro-Mix 200	0.398*	-	<0.03	<0.015	-	-	3/10/77 - Cambridge*	0.081	1.62	1.063	3/10/77 & 3/18/77-Cambridge*	3/10/77 & 3/18/77-Cambridge*	3/10/77 & 3/18/77-Cambridge*
Hectro-Mix 300	0.081*	-	-	-	-	-	3/12/77 - Cambridge	TO BE SCHEDULED	-	-	-	-	-
Hectro-Mix 350	0.156*	-	-	-	-	-	3/10/77 - Cambridge*	0.02*	0.07	0.015	<0.14	<0.14	<0.035
Turf Builder (#4 light)	-	-	-	-	-	-	3/10/77 - Cambridge*	<0.034*	<0.03	0.07	0.018	-	-
Turf Builder (#4 dark)	-	-	-	-	-	-	TO BE SCHEDULED	-	-	-	-	-	-
Vermite (#2 Cambridge Grade)	<0.003	-	-	-	-	-	TO BE SCHEDULED	-	-	-	-	-	-
								<0.009*	-	-	0.1*	0.031	-
								<0.009*	-	-	0.17	0.043	-

* Samples assayed of products actually used on simulated job site.

** Professional vermiculite was 4.32%; Consumer vermiculite was 1.62.

TABLE III (Continued)

-2-

03629734

D. Masonry Fill (FWE)

From visiting job sites and talking with masonry contractors, 1 hour is generally the maximum time spent pouring MF. Pouring conditions vary from job-to-job and from contractor-to-contractor. A few conditions are as follows:

1. Lay block/brick part way - Pour MF.
2. Lay block and pour MF at scaffold height.
Several men pouring so as not to tie up scaffold.
3. Lay all block/wall, fill w/MF and Cap.

The following are jobs sampled:

<u>Construction</u>	<u># Bags</u>	<u># Men</u>	<u>Total Time/ Da. (Min.)</u>	<u>Location</u>
Block Core	28	2	41	West Palm Beach
Block Core	33	1	85	Columbus, GA.
Brick Cavity	100	1	34	Oklahoma City
Block Core	75	2	71	Dallas
			TWA = $\frac{1}{8}$	

FWE:mem

4-4-77

15101974

TABLE IV - GUIDELINES FOR RESPONDING TO REQUESTS REGARDING ASBESTOS IN OUR PRODUCTS

SOUTH CAROLINA		LIBBY	
Frequency	Amount	Frequency	Amount
MONOKOTE	Most samples contain no detectable tremolite; Occasionally one may contain tremolite	Negligible	Most samples contain no detectable tremolite; Occasionally one may contain tremolite
ZIC	Samples contain tremolite; predominantly non-asbestos form	Small	Samples contain tremolite
MF	Samples contain tremolite; predominantly non-asbestos form	Small	Samples contain tremolite
AF	Samples contain tremolite; predominantly non-asbestos form	-	Samples contain tremolite
Ind	Samples contain tremolite; predominantly non-asbestos form	Small	Some samples may contain tremolite
TV	Samples contain tremolite; predominantly non-asbestos form	Small	Samples contain tremolite
RC	Some samples may contain tremolite; predominantly non-asbestos form	Minute	Most samples contain no detectable tremolite; Occasionally one may contain tremolite
HM	Some samples may contain tremolite; predominantly non-asbestos form	Minute	Most samples contain no detectable tremolite; Occasionally one may contain tremolite

15101975

TABLE IV

-2-

DEFINITIONS:

Small	1.0 - 6.0%
Very Small	0.5 - 1.0
Minute	Less than 0.5
Trace	Detectable, but not quantifiable
Negligible	Not detected by normal analytical procedures in the sample as manufactured.

03629736

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ESW/CCR
1-30-77

TABLE V - MH-4 W/LIBBY "3 03629737

— 2/3 H, 77

				FIBER Count (f/m ²)		
DATE	JOB SITE (1977 LOCATION)	JOB	MIN.	MAY	TWA	COMMENTS
1	HYATT REGENCY 3/10 DALLAS	MIXED NOZZLE	≤ 0.75 0.0	≤ 0.25 ≤ 0.19 ≤ 0.110	≤ 0.111 0.058 0.118	✓
2	SO. COUNTY HALL 3/10 OF JUSTICE	MIXED NOZZLE	0.9 < 1.5 ≤ 0.16	0.12 ≤ 0.30	0.038 0.186	✓
3	FREMONT CALIF	CLEANUP	≤ 0.20.55	2.3	0.250	✓
4	KALIE FEDERAL 3/11 SAVINGS FLOOR	MIXED NOZZLE	0.2 < 0.19 0.16	0.13 0.38	0.019 0.196	✓
5	BURBANK CALIF					
6	WESTMINSTER 1/26 COURT BLDG	MIXED NOZZLE	≤ 0.40.55 0.05	0.19 0.21	0.069 0.072	✓
7	WESTMINSTER CA CLEANUP			0.03	0.024	
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